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VOL. LXX, No. 1816

FRIDAY, OCTOBER 18, 1929

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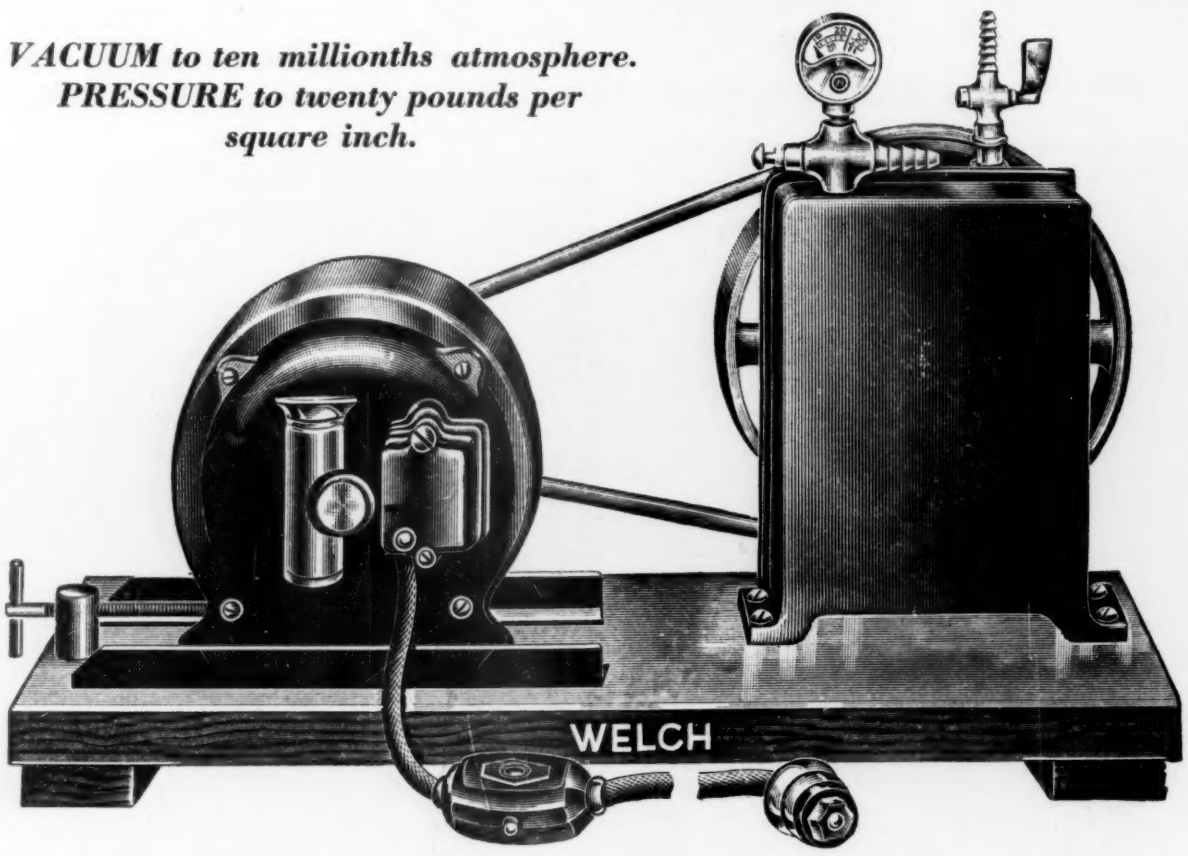

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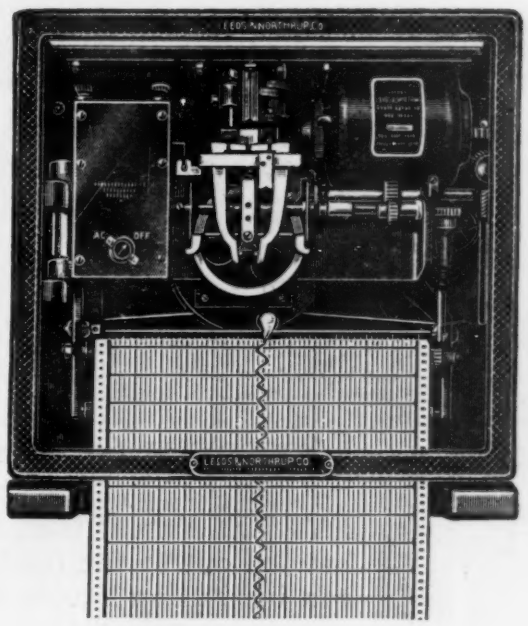

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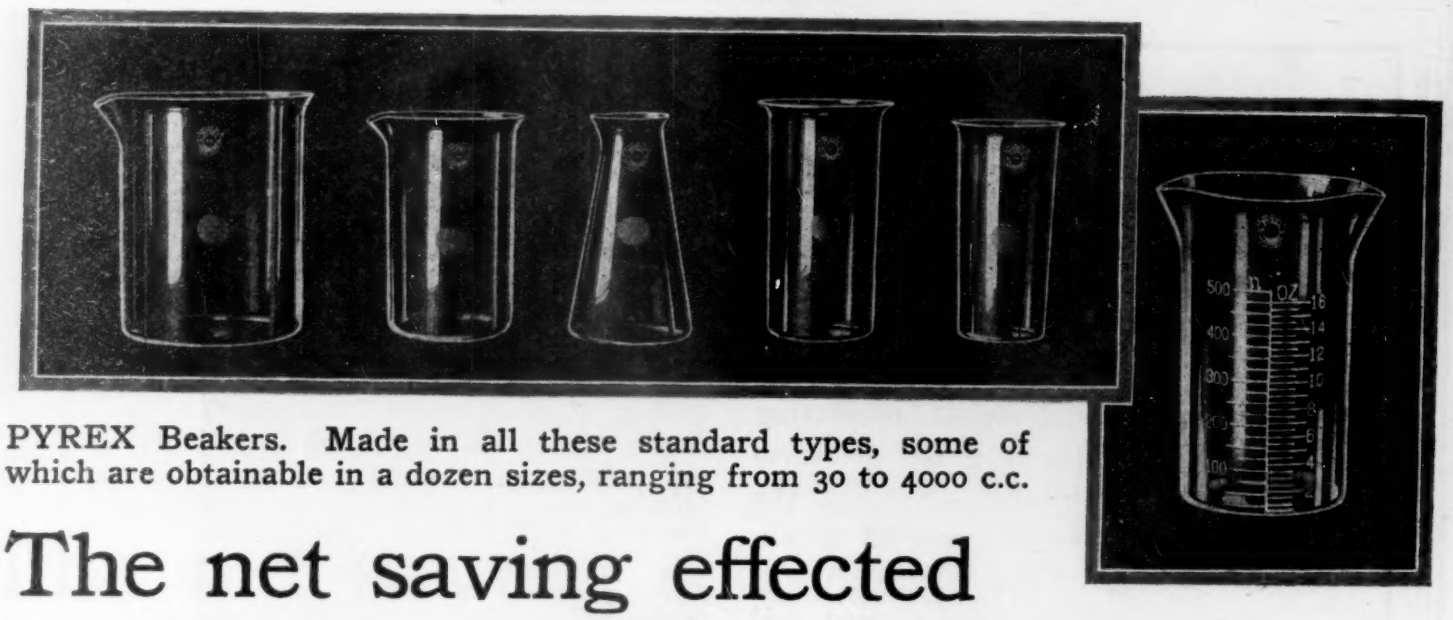

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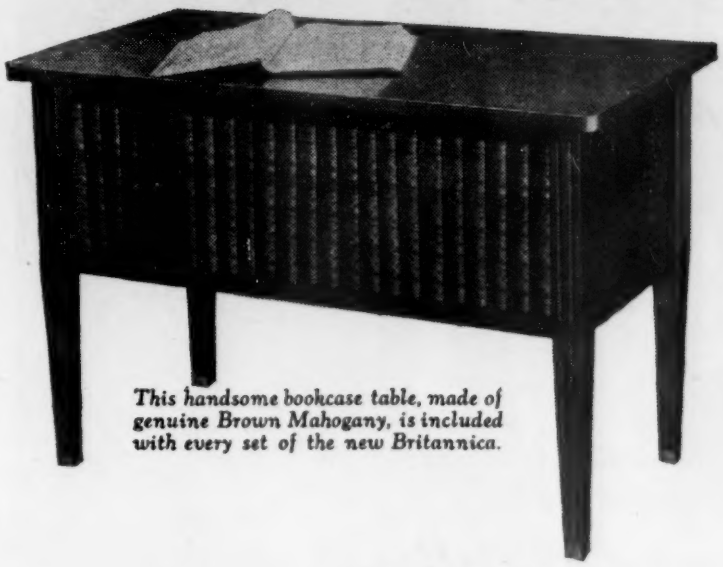

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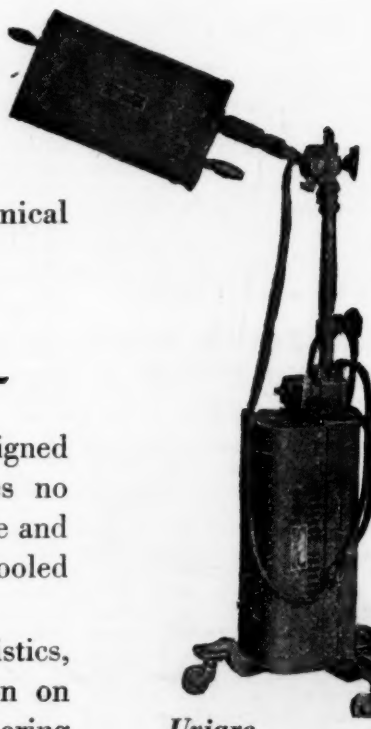

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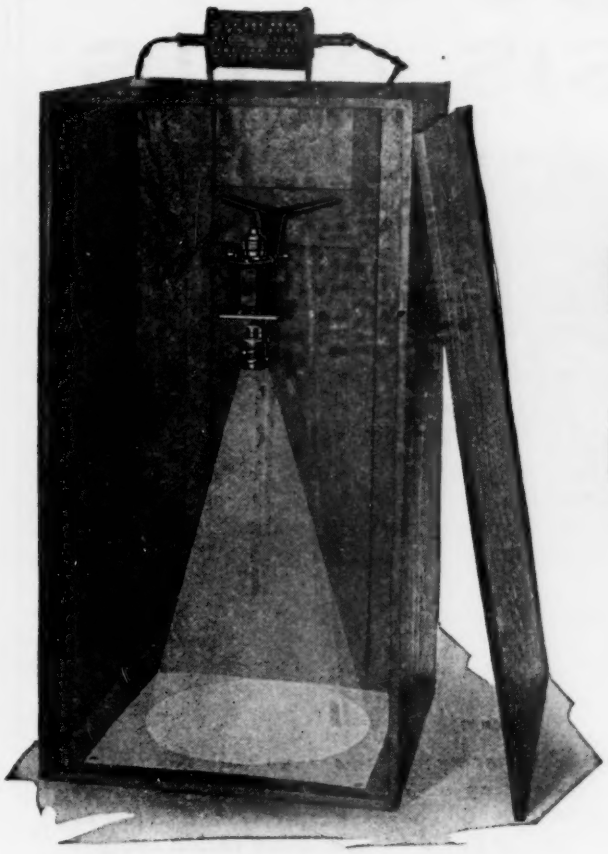

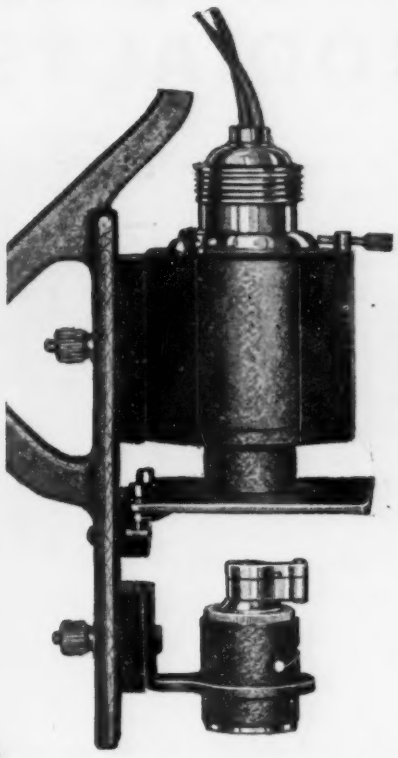

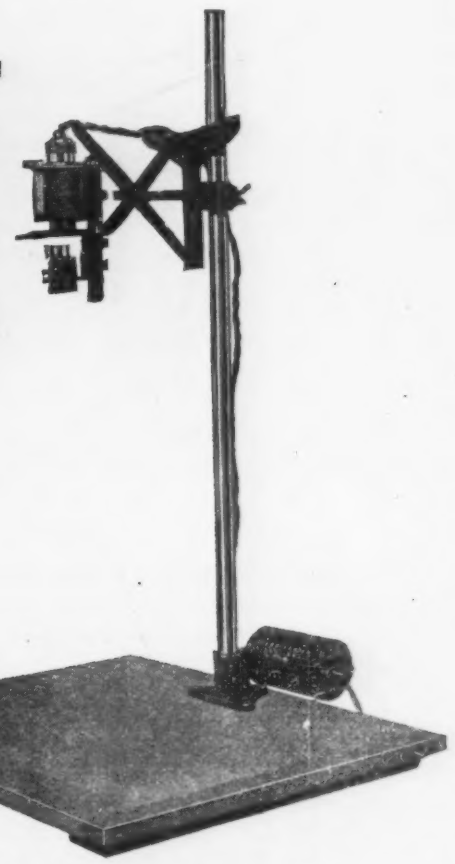

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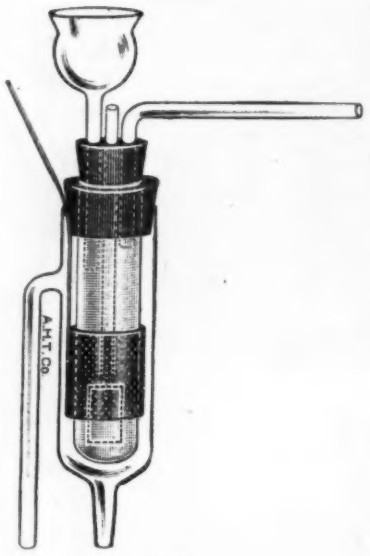

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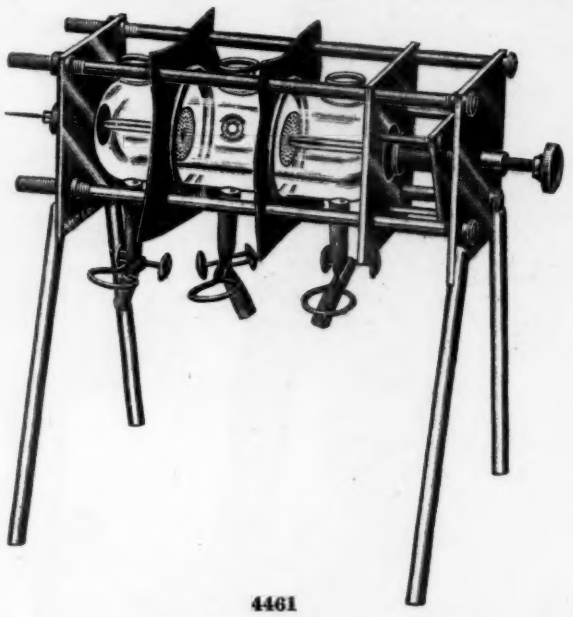

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See Richard Bradfield, *Journal of the American Society of Agronomy, Vol. 19, No. 11 (November, 1927), p. 1015.*

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SCIENCE

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THE FOURTH PACIFIC SCIENCE CONGRESS

By Dr. T. WAYLAND VAUGHAN

SCRIPPS INSTITUTION OF OCEANOGRAPHY, UNIVERSITY OF CALIFORNIA

HOSTS AND ORGANIZATIONS

THE Fourth Pacific Science Congress was held in Weltevreden and Bandoeng, Java, from Thursday, May 16, to Saturday, May 25, 1929, under the auspices of the Netherlands Indies Science Council, with the support of the Netherlands Indies government. The patrons of the congress were His Excellency the Minister for Colonial Affairs and His Excellency the Minister for Foreign Affairs of the Netherlands and His Excellency the Governor-General of the Netherlands Indies.

The general president of the congress was Dr. Otto de Vries, director of the Rubber Experiment Station, Buitenzorg; the general vice-president, Dr. J. Clay, professor of physics at the Technical Faculty, Bandoeng; first general secretary, Dr. H. J. Lam, herbalist to the Botanical Gardens, Buitenzorg; the joint general secretary, Dr. H. J. T. Bylmer, military surgeon and anthropologist, Batavia, and the treasurer, Dr. H. M. Hirschfeld, of the Java Bank, Batavia. The scientific work of the congress was divided into three divisions, of which the officers were, for the Physical Sciences: *Chairman,* Mr. A. C. de Jongh, director of the Geological Survey; *secretary,* Dr. S. W. Visser, subdirector Royal Magnetic and Meteorological Observatory. Biological Sciences: *Chairman,* Dr. W. M. Docters van Leeuwen, director of the Botanical Gardens of Buitenzorg; *secretary,* Dr. K. W. Dammerman, chief of the Zoological Museum and Laboratory, Buitenzorg. Agricultural Sciences: *Chairman,* Dr. J. J. B. Deuss, director, Tea Experiment Station, Buitenzorg; *secretary,* Dr. J. Th. White, of the General Agricultural Experiment Station, Buitenzorg. Of the Social Branches, the chairman of the subcommittee on excursions and entertainment was Dr. Ch. E. Stehn, volcanologist; the chairman of the subcommittee on accommodations, Dr. W. F. Gisolf, petrographer, and the chairman of the sub-

committee on publications, Dr. J. Stroomberg, Department of Agriculture. All the officials whose names are given had onerous duties, and those who attended the congress owe them a debt of thanks.

The congress was formally opened in Weltevreden on Thursday, May 16, by His Excellency Jhr. Mr. A. C. de Graeff, governor-general of the Netherlands Indies. After the opening meeting the members of the congress moved to Bandoeng, where the subsequent sessions were held from Saturday, May 18, to Saturday, May 25.

Attendance

The total number of overseas delegates at the congress was about 165 and there were about seventy overseas participants. There were between 235 and 240 overseas delegates and participants. The countries represented and the respective number of delegates were as follows: Australia, 9; Canada, 2; Ceylon, 1; China, 19; Denmark, 1; France, 2; Germany, 2; Great Britain, 3; Hawaii, 4; Hongkong, 3; French Indo-China, 8; Japan, 39; Macao, 1; Netherlands, 25; New Zealand, 2; Philippine Islands, 8; Siam, 2; Straits Settlement, 14; Sweden, 1; United States, 26. In this list there are four duplications. There were twenty-three delegates from the Netherlands Indies, but a larger number, perhaps most, of the scientific men resident there were in attendance. Among the delegates there were many men of great distinction. Not all of them can be mentioned, but a few of the seniors were Professor A. Lacroix, permanent secretary of the Academy of Sciences, Paris; Professor G. Steinmann, of the University of Bonn; Professor G. Elliot Smith, of Cambridge University, England; Emeritus Professor M. Miyoshi, of Tokyo University, and Professor F. A. F. C. Went, president of the Royal Academy of Sciences, Amsterdam.

The large number of delegates and participants taxed the ingenuity of the hosts in providing for their guests. Bandoeng, the city in which the scientific sessions were held, has a total population of about 112,000, of which only about 10,700 are Occidentals. The difficulty of taking care of the large number of overseas guests and the scientific residents of the Netherlands Indies can easily be imagined. Some inconvenience under these circumstances was to be expected, but all the guests should feel grateful for the efforts that our hosts made to accommodate every one. The large attendance was gratifying, for it showed the interest both of the different countries around the Pacific and also of individuals in the work that is being done by the Pacific Science Congresses.

Scientific Program

The scientific program of the congress was divided into a series of symposia on the problems of the Pacific, the most important of which were on subjects as follows: geo-tectonic movements; results of modern methods for volcanological research; chemistry of igneous rocks; results of gravity determinations at sea; present status of oceanographical investigations; coral reefs; scientific and commercial development of fisheries; geological mapping of the countries on the west side of the Pacific; paleontological characteristics and correlation of Tertiary and post-Tertiary formations; prehistoric man in the Pacific; ethnological problems, especially of the countries bordering the western tropical and subtropical Pacific; land classification and utilization; rice problem, its technical and economic aspects; improvement of plants for permanent crops; soil technology and classification; forestry problems; protection of nature. In addition to papers on the topics above listed there were also papers on meteorology, zoogeography and phytogeography.

As many papers were offered to the congress, the executive committee decided to have one person compile the substance of all those papers dealing with a specific subject and to present in one lecture the abstracts of a number of communications, instead of having the authors of different communications personally present their own papers or abstracts. It was expected that the lecture would be followed by discussion. This method in many cases worked satisfactorily. The problem of the presentation of so much material was a difficult one and entire satisfaction was probably too much to expect. Much assistance in grasping the essentials of the communications was rendered by the publication, for many papers, of preprints or advance abstracts which were distributed at the sessions.

Besides the sessions on the scientific program, there were important committee meetings, among which may be mentioned two joint meetings of the international committees on the oceanography and coral reefs of the Pacific.

Resolutions

At the final session of the congress twenty-eight resolutions were adopted. They covered the following subjects: A world map of isopors for a fixed epoch; a general geological map of the countries around the South China Sea; a revision of the data compiled for the Geological Congress at Toronto, 1913, of the coal resources of the countries around the South China Sea; a systematic study of rock alteration in the countries around the South China Sea; monthly interchange of special bulletins of important earthquakes between cooperating observatories of the Far East, without altering existing arrangements; the adoption of the International Code of Zoological Nomenclature by all workers on the taxonomy of both extinct and living animals; the intensive investigation of the geology and physiography of coral reefs and associated

phenomena in the Society Islands and of some nearby atoll, with borings, if practicable, through the barrier reefs at places which may seem desirable for such tests; an intensive study of Rose Atoll (a nullipore atoll) in the Samoan Archipelago; elaboration of a plan for oceanographic stations around the Pacific so as to insure a complete international oceanographic survey of the Pacific Ocean; the establishment of an international marine biological and oceanographical station in the Malay Archipelago; the commendation of the Carnegie Institution of Washington, the Netherlands government, the Scripps Institution of Oceanography of the University of California and the Carnegie Institution of Washington, and the section on oceanography of the Pacific committee of the Academy of Sciences of the U. S. S. R. for the efforts that they are making to prosecute oceanographic investigations in the Pacific; the commendation of the navies of the different Pacific countries for the valuable contributions that they are making to knowledge of the oceanography of the Pacific; the collection and critical examination of all existing data on the surface temperatures and salinities of the waters in the Pacific Ocean, with a view to the utilization of such data in the solution of problems of circulation of the oceanic waters and for many other purposes; the yearly publication of the results of marine soundings by the echo method and the standardization of scientific methods for calculating depth from the time interval in echo sounding; identification of plankton organisms of the Pacific and the distribution of named specimens to the different institutions; creation of a standing committee for the investigation of blood grouping in the Pacific; establishment of a standing committee on the tropical fisheries of the Pacific; creation of a standing committee for the protection of nature in and around the Pacific; promotion of the passage of governmental regulations by which the importation of all living specimens or skins, feathers or other parts of the bodies of wild animals will be prohibited, unless the consignment is accompanied by a license issued by proper authorities; limitation of unrestricted collecting of plants and animals in the Pacific Islands; adoption of adequate steps for the preservation of the Australian fish, *Epiceratodus forsteri* (Krefft); study of the extent of cross pollination among rice plants in different countries; formation of a standing committee on soil surveys and classification; formation of a standing committee on land classification and utilization in the Pacific; formation of a standing committee on economic entomology for the Pacific countries. The resolutions that were adopted at the congress were not merely the expression of wishes on the part of the delegates, but for each one of the resolutions which requires action there were men who intended to exert themselves to their utmost to see that the resolution shall be made effective.

In summarizing the scientific work of the congress it may be said that present information on many subjects was brought up to date as nearly as possible, and thereby those who attended were enabled to inform themselves with reference to the status of investigations in numerous fields. The resolutions adopted are indications of action to follow the discussions at the congress. It appears to the writer of this report that more useful work was accomplished at the Fourth Pacific Science Congress than at any previous congress, notwithstanding the steady progress from the meeting of the first congress in the Hawaiian Islands in 1920 through the congress in Australia in 1923 and the congress in Japan in 1926.

Entertainment and Excursions

The overseas delegates were royally entertained during the excursions before and after the congress and during the sessions of the congress itself. They were provided with hospitality either in hotels or in private houses and were supplied with passes for the government transportation lines. There was much delightful entertainment, both official and private, some of which was unique. This included plays from the Mahabharata by the Javanese and native dances and plays. Some of the native dances were of extraordinary interest.

Before and after the congress there were excursions which gave the visitors opportunities to see many of the interesting features of Java. Among these were the visit to Krakatau; the excursion to the coral reefs of Batavia Bay; the inspection of many localities of geological interest, including the famous Trinil locality; visits to Boroboedoer, Prambanan and other important ancient religious structures; visits to the different scientific institutions, among which the famous garden at Buitenzorg deserves special mention; inspection of the different kinds of agricultural estates, particularly rubber, chincona, tea and sugar, and inspection of native arts and crafts industries.

After the congress adjourned there was also an excursion to the Island of Bali.

Meeting-Place of the Congress in 1932

Two invitations for the next place of meeting were received, one from the National Research Council of Canada, supported by the Canadian government, and the other from French Indo-China. The Canadian invitation had been previously extended in Japan, in 1926, but was withdrawn in favor of the invitation from the Netherlands Indies. When the Canadian invitation was repeated in Java it was accepted, but at the same time the hope was expressed that the next meeting of the congress, which would probably be in 1935, would be held in French Indo-China.

Conclusion

Java was hot and there were other discomforts, but all who were present at the congress returned to their homes appreciative of the charms and manifold subjects of scientific and other kinds of interest of what is perhaps the most fascinating of tropical islands, deeply grateful for the courtesies and hospitality extended to them and convinced that the Fourth Pacific Science Congress was the most successful of that series of congresses. Thanks are due all of those who contributed to the social enjoyment and the scientific accomplishments of the congress, but it may be permissible to emphasize the part played by the general president, Dr. Otto de Vries. He showed capacity in the organization of the congress, his handling of all matters connected with it was tactful and his genial personality endeared him to every one. We congratulated him on his success and told him that we were proud of him.

Representatives of Institutions and Organizations of the United States at the Fourth Pacific Science Congress, Batavia and Bandoeng, Java, May 16 to 24, 1929

Mr. George Arceneaux, Office of Sugar Plant Investigations, Bureau of Plant Industry, U. S. Department of Agriculture, Homer, Louisiana.

Dr. William H. Brown, director, Philippine Bureau of Science, Manila, Philippine Islands.

Professor Hubert Lyman Clark (and Mrs. Clark), curator of marine invertebrates, Museum of Comparative Zoology, Harvard University.

Lieutenant-Commander Leo O. Colbert, director, Coast and Geodetic Survey for the Philippine Islands, Manila, Philippine Islands.

Dr. Frederick V. Coville (and Mrs. Coville), principal botanist, Bureau of Plant Industry, U. S. Department of Agriculture.

Professor George B. Cressey, Department of Geology, Shanghai College, China.

Dr. Heber D. Curtis, director, Allegheny Observatory, University of Pittsburgh.

Dr. George A. Dorsey (and Mrs. Dorsey), lecturer, New School for Social Research, 465 West 23rd Street, New York City.

Mr. Harry T. Edwards, senior technologist, Office of Fiber Plants, Bureau of Plant Industry, U. S. Department of Agriculture.

Mr. Roy H. Finch, associate volcanologist, Lassen Volcano Observatory, Geological Survey, U. S. Department of the Interior, Mineral, California.

Mr. Henry W. Fowler, associate curator of vertebrate zoology, Academy of Natural Sciences, Philadelphia, Pennsylvania.

Dr. Fred W. Foxworthy, forestry research officer, Kuala Lumpur, Federated Malay States.

Professor E. M. Harvey, Department of Horticulture, Oregon State Agricultural College, Corvallis.

Professor Wm. E. Hoffmann, professor and head of the department of biology, Lingnan University, Canton, China.

Dr. Carl L. Hubbs, curator of fishes, Museum of Zoology, University of Michigan.

Professor Emeritus A. C. Lawson, Department of the Geological Sciences, University of California.

Professor George D. Louderback (and Mrs. Louderback), Department of the Geological Sciences, University of California.

Mr. Augustine B. McManus (and Mrs. McManus), senior scientist, Hydrographic Office, U. S. Navy Department.

Mr. Paul Banwell Means, 296 Oranje Nassaustraat, Medan, Sumatra.

Professor John A. Miller (and Mrs. Miller), director, Sproul Observatory, Swarthmore College.

Professor Robert E. Park (and Mrs. Park), Department of Sociology and Anthropology, University of Chicago.

Dr. Robert D. Rands, senior pathologist, Office of Sugar Plant Investigations, Bureau of Plant Industry, U. S. Department of Agriculture.

Dr. Oswald Schreiner, principal biochemist in charge, Soil Fertility Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture.

Professor W. A. Setchell (and Mrs. Setchell), Department of Botany, University of California.

Dr. Philip S. Smith (and Mr. Sidney B. Smith, Miss Katherine Smith, son and daughter), chief Alaskan geologist, Geological Survey, U. S. Department of the Interior.

Dr. T. Wayland Vaughan, director, Scripps Institution of Oceanography, University of California, La Jolla, California.

Participants (not members) of the congress: Mr. J. Gordon Carlson, assistant to Dr. Fowler, zoology; Mr. J. Rupert Mason, irrigation expert, San Francisco (and Mrs. Mason), agriculture; Mr. Larry B. Miller, Swarthmore College, astronomy; Mr. Walter H. Robinson, Swarthmore College, astronomy.

THE NINTH INTERNATIONAL CONGRESS OF PSYCHOLOGY

By Professor HERBERT S. LANGFELD

PRINCETON UNIVERSITY, FOREIGN SECRETARY OF THE CONGRESS

The Ninth International Congress of Psychology was held at Yale University from September 1 to 7, 1929. "Enfin, enfin en Amerique!" exclaimed Professor Claparède, in his address on the opening day. For although this meeting took place on the fortieth anniversary of the First International Congress, it is

the first time the congress has convened on American soil. As far back as the Congress of London in 1892, it was proposed to hold a meeting in America, and several times since then plans for an American Congress were started, but in every case some obstacle, either personal, political or economic, intervened to several times since then plans for an American Committee, consisting of Baldwin, James, Hall, Fullerton, Donaldson and Witmer, decided it was impracticable. In 1905 in Rome, James invited the congress to meet in the United States, but when he found that his friend, Flournoy, had invited the congress to meet in Geneva, he withdrew his proposition. In 1909 at Geneva, the American invitation was accepted for a meeting in 1913, but the death of James caused a postponement. Then came the war. At the Congress of Oxford in 1923 it was again proposed to meet in the United States, but as it was evident that the economic conditions of Europe would prevent most of the foreigners from attending, the idea was again abandoned. And so it was not until 1929 that plans initiated at the Congress of Groningen could be brought to a successful conclusion.

The congress was held under the auspices of the American Psychological Association, and the latter's annual meeting, which usually takes place in December, was merged with that of the International Congress. The American Psychological Association elected James McKeen Cattell president of the congress, J. R. Angell vice-president and E. G. Boring secretary. The association also elected a national committee, consisting of J. E. Anderson, Minnesota; J. R. Angell, Yale; Madison Bentley, Cornell; E. G. Boring, Harvard; E. A. Bott, Toronto; H. A. Carr, Chicago; J. McK. Cattell, New York; Raymond Dodge, Yale; Knight Dunlap, the Johns Hopkins; S. W. Fernberger, Pennsylvania; W. S. Hunter, Clark; H. S. Langfeld, Princeton; William McDougall, Duke; W. B. Pillsbury, Michigan; C. E. Seashore, Iowa; L. M. Terman, Stanford; E. L. Thorndike, Columbia; H. C. Warren, Princeton; M. F. Washburn, Vassar; R. S. Woodworth, Columbia, and R. M. Yerkes, Yale. R. S. Woodworth was appointed treasurer, W. S. Hunter executive secretary, H. S. Langfeld foreign secretary, Raymond Dodge chairman of the program committee and R. P. Angier chairman of the local committee.

The First International Congress, which was held in Paris in 1889, had two hundred members. The total registration of the Ninth International Congress was 1,051 persons, and there were also 394 absentee members, of whom 271 were Americans and 123 foreigners. This enrolment was very much larger than at any previous international congress. An analysis of the enrolment revealed the following facts: American members, 722 (men 471, women 251); wives of American members, 82; American guests, 124 (men 71, women 53); foreign members, 104 (men 90, women 14); wives of foreign members, 14; foreign guests, 5.

The American members came from forty-two states, Canada, Mexico and Porto Rico. The largest delegation was from New York (196). Next in order came Massachusetts 80, Ohio 47, Illinois 42, Pennsylvania 40, Connecticut 39, Minnesota 29, Michigan 24, New Jersey 24, California 20. The foreign members were from twenty-one countries. England led with 22, then came Germany 17, Russia 10, Netherlands 8, India 6, and Austria, France, Japan and Switzerland, 5 each. The governments of China, Belgium, Denmark, Netherlands, India and Greece appointed official representatives.

Prominent among the foreigners were I. Pavlov, the famous leader of the Russian reflex school; Ed. Claparède, of Geneva, who for many years has been productive in both the theoretical and the experimental field and who has shown broad interests in animal behavior; C. Spearman, of the University of London, who has been the champion for many years of the general factor of intelligence; Beatrice Edgell, of the faculty of the same university; F. C. S. Schiller, a staunch supporter of the philosophy of William James and chief exponent of Pragmatism; James Drever, of Edinburgh, who has one of the best laboratories in the United Kingdom; R. H. Thouless, of Glasgow, who has specialized in the psychology of religion; L. Wynn-Jones, of Leeds, and F. Aveling, of London, both of whose names appear frequently in the *British Journal of Psychology* and other scientific journals; Wolfgang Köhler, of Berlin, leader of the *Gestalt* movement, and Kurt Lewin, who conducts many important experiments in Köhler's laboratory; William Stern, of Hamburg, who together with his wife wrote one of the first studies of early childhood and has ever since been a leader in child psychology; W. Wirth and Otto Klemm, of Leipzig, the former an authority on psychophysics, the latter author of a popular history of psychology; Gustav Kafka, of Dresden, author of a well-known comparative psychology (Kafka has remained in America to lecture for a half-year at the Johns Hopkins); Otto Lipmann and Hans Rupp, of Berlin, both exceedingly productive applied psychologists; D. Katz, of Rostock, who has produced numerous important experimental studies; H. Piéron, the brilliant experimentalist of the Sorbonne; Karl Bühler, of Vienna, the well-known experimental and educational psychologist, and his wife, Charlotte Bühler, who has recently published a book on childhood and is lecturing at Barnard during the winter semester; A. Michotte, of Louvain, who produces numerous laboratory studies and plans val-

uable apparatus; A. Decroly, of Brussels, who is a leader in educational psychology; E. Rubin, of Copenhagen, who has made memorable contributions to the *Gestalt* movement; F. Roels, of Utrecht, a pupil of Michotte and secretary of the last international congress; A. Grünbaum, of Amsterdam, who has had a broad training in psychology and is at present specializing in abnormal psychology; M. Ponzo, of Turin, who together with his colleague Kiesow is very productive in experimental laboratory work; I. Spielrein, of Moscow, who is active in industrial psychology; P. S. Kupalov, of Moscow, one of the best of the reflex men (he has been working recently in Cornell); A. R. Luria, of Moscow, prominent among the younger group of Russia and a specialist in educational psychology; E. Mira, of Barcelona, energetic worker in experimental psychology; G. Jaederholm, of Gothenburg, who is well-known in America through his frequent visits.

All the members of the congress and their wives were housed in the Harkness Memorial Quadrangle and meals were served in the university dining-hall. The foreigners were guests of Yale during the week of the congress, and the generous hospitality of the university was greatly appreciated by them. The fact that all the psychologists lived in the same building helped to preserve the unity of the unusually large group, and the beautiful court of the dormitory offered an inviting place for many impromptu discussions, which frequently lasted into the small hours of the morning.

Arrangements were made for excursions in the afternoon to the various laboratories and other places of interest in New Haven. On Wednesday afternoon, there was a reception by the president of Yale University in the new School of the Fine Arts, at which the members of the staff of the psychology department of Yale assisted. Plans for the comfort and welfare of the members were carried out by the local committee to the smallest detail, so that, in the words of Professor Jastrow, "Yale was, in truth, a New Haven of human relations."

The general scheme of the program committee was to obtain papers from the largest possible number of members, in order that the proceedings should present a true idea of the present status and tendencies of psychology throughout the world. In order to carry out this plan, it was arranged to have twenty-minute papers by invitation in the morning sessions and numerous symposia in the afternoon, with papers of eight minutes in length. The evenings were devoted to lectures by a selected number of distinguished men. There were usually three parallel sessions in the morning, and from five to seven parallel symposia in the afternoon. There were seventy-four papers listed in the morning sessions, and 350 in the symposia. In addition, there were a few papers read by title only. Thirty-seven of the morning contributions and forty-two of the symposia were by foreigners. It is evident that no one was able to hear more than a very small fraction of the papers, but psychology is fast breaking up into specialized groups, and most persons were able to chart their route through the program without too many cross currents of conflicting interests. After the evening lectures, there was an informal smoker in the dining hall, where there was also an exhibition of instruments and books.

On the morning of September 2, the congress was officially opened with a graceful address of welcome by President J. R. Angell, of Yale, who generously offered to the visitors the hospitality of the university. Dr. J. McKeen Cattell followed with an address as president of the congress. Dr. Cattell described the development of psychology in America and gave a very clear and convincing proof of the great progress which psychology has made in this country in the last few decades. Among other facts, he described the steady growth of the membership of the American Psychological Association from thirty-one regular members in 1892 to 540 in 1929, and presented an analysis of contributions to psychology. Professor Ed. Claparède, as secretary of the international committee, replied to the address of welcome with an account of the history of the international congress. He particularly emphasized the pleasure with which the international committee accepted the invitation to come to America. "For us of the Old World," he said, "America has danced before our eyes for forty years as the promised land." The last of the morning speeches was by Mr. William John Cooper, who came from Alaska to New Haven for the purpose of representing the national government at the congress. He spoke particularly of the great value of psychology to education.

The first of the evening lectures was by Dr. I. Pavlov, of Leningrad. Although the famous eighty-year-old scientist delivered his address in Russian, he spoke with such enthusiasm and dramatic fervor that even if Dr. Anrep had not acted as interpreter, his gestures and voice alone would have held the interest of the audience. Dr. Pavlov described the most important results and theoretical implications of his many years of work on the conditioned reflex. The second address was by Professor Wolfgang Köhler, of Berlin, who explained the main concepts of the *Gestalt* psychology, and described some of the more important problems which he and his school have attempted to solve. His clear exposition of this latest tendency in psychology will undoubtedly be of considerable assistance to the members in understanding Dr. Köhler's recent book on the subject.

Tuesday evening the first lecture was by Professor A. Michotte, of Louvain, who described some of the experiments on perception which he and some of his collaborators are performing in his well-organized laboratory. One of his most interesting problems is that of the illusion of movement of one's body which occurs when one's hands are moved involuntarily by a specially designed instrument, while one's eyes are shut and one's body is held stationary. Professor Piéron, of Paris, spoke upon the nature of pain, a subject that has interested him for some time. He is of the opinion that pain has a quality distinctly different from the sensations and he developed his thesis with his customary charm of exposition.

The banquet was held on Wednesday night, and was attended by 554 members and guests. After the dinner, Professor K. S. Lashley delivered the presidential address of the American Psychological Association, which is generally given at the annual meeting of the association. Professor Lashley spoke upon the basic neural mechanism in behavior, and it was the general opinion that his address was the outstanding feature of the congress. He gave an inspiring exposition of his latest views concerning the vicarious functioning of the central nervous system, views which are based upon his numerous experiments upon animals. His ideas gave evidence of keen insight and imagination and will undoubtedly have an important place in the history of physiology.[1]

The following evening, Professor William Stern, of Hamburg, spoke upon the science of human beings. He dwelt particularly upon the problem of personality and stressed the necessity of studying personality as a unit and not as a group of detached functions, a view which is in accord with *Gestalt* psychology. Professor M. Ponzo lectured upon psychic dynamism and the researches of the school of psychology of Turin.

The final lectures, on Friday, were by Professor Carl Spearman, of the University College of London, and Professor E. L. Thorndike, of Teachers College, Columbia. Professor Spearman offered a theory of the creative mind in terms of the completion of analogies. To illustrate his thesis, he showed the manner in which the mind completes a melodic sequence in music or a sequence of lines or figures in the visual arts. Professor Thorndike described some experiments which seemed to refute the old idea of the potency of primacy and recency in learning. He also quoted results to prove that repetition seems to be more important in learning than the *Gestalt* psychologists would lead one to suppose.

It is obviously impossible in a report such as the present one to give descriptions of the papers presented.[2] An enumeration of the various divisions of the morning sessions and the topics discussed in the symposia may, however, be of value as showing the range of interests of the psychologists of 1929.

In the morning sessions, there were usually six papers in each division. The grouping was as follows:

Theory and History of Psychology: H. C. WARREN, Princeton, *chairman.*
Comparative Psychology: J. R. ANGELL, Yale, *chairman.*
Educational Psychology: E. L. THORNDIKE, Teachers College, Columbia, *chairman.*
Methodology and Technique: CARL SPEARMAN, University College, London, *chairman.*
Social Psychology: JAMES DREVER, Edinburgh, *chairman.*
Child Development: KARL BÜHLER, Vienna, *chairman.*
Physiological Psychology: HENRI PIÉRON, Paris, *chairman.*
Psychology of Personality: WILLIAM STERN, Hamburg, *chairman.*
Abnormal and Clinical Psychology: JOSEPH JASTROW, New York, N. Y., *chairman.*
Experimental Psychology: A. MICHOTTE, Louvain, *chairman.*
Psychology of Industry and Personnel: F. ROELS, Utrecht, *chairman.*
Theory and History of Psychology: EDUARD CLAPARÈDE, Geneva, *chairman.*
Experimental Psychology: WOLFGANG KÖHLER, Berlin, *chairman.*

The number of papers in the symposia varied considerably. Under certain circumstances, the number of papers offered might be taken as an indication of the interest in that particular subject. But in this instance it may be suspected that the size of the symposium depended in great measure on the enthusiasm and energy which the chairman showed in his preliminary arrangements. The list of symposia follows:

Animal Behavior: C. P. STONE, Stanford, *chairman.*
First Session: *Communications on Experimental Studies of Native or Congenital Behavior.* (11 papers.)
Second Session: *Communications on Learning and the Higher Thought Processes.* (9 papers.)
Applications of Psychology to Methods of Teaching: C. H. JUDD, Chicago, *chairman.* (9 papers.)
Effects of Drugs: R. H. PAYNTER, Long Island University, *chairman.* (9 papers.)
Industrial Psychology: A. T. POFFENBERGER, Columbia, *chairman.* (8 papers.)
Maladjustments: F. L. WELLS, Boston Psychopathic Hospital, *chairman.* (13 papers.)
Psychogalvanic Reflex: CARNEY LANDIS, Wesleyan University and Behavior Research Fund, *chairman.* (15 papers.)

[1] The address will be published in the January number of the *Psychological Review.*

[2] Abstracts of all papers will be printed in the *Proceedings,* which will appear about January and which may be obtained from the Psychological Review Company, Princeton, New Jersey.

Theoretical Psychology: MADISON BENTLEY, Cornell, *chairman.* (6 papers.)

Character and Personality: F. H. ALLPORT, Syracuse, *chairman.* (18 papers.)

General Intelligence: E. A. CULLER, Illinois, *chairman.* (6 papers.)

Legal Psychology: CARL MURCHISON, Clark, *chairman.* (24 papers.)

Subdivisions:

I. *Approaches to the Field of Legal Psychology.*
II. *Juvenile Delinquency.*
III. *General Delinquency.*
IV. *Detection.*
V. *Punishment.*
VI. *Social Implications.*

Meaning and Symbolism: C. A. RUCKMICK, Iowa, *chairman.* (11 papers.)

Psychophysics: S. W. FERNBERGER, Pennsylvania, *chairman.* (No formal papers.)

Abnormal Psychology: J. W. BRIDGES, McGill, *chairman.* (13 papers.)

Child Development: J. E. ANDERSON, Minnesota, *chairman.* (20 papers.)

Eye-Movements: W. R. MILES, Stanford, *chairman.* (4 papers.)

Laboratory and Teaching Devices: K. M. DALLENBACH, Cornell, *chairman.* (16 papers.)

Memory and Learning: E. S. ROBINSON, Yale, *chairman.* (17 papers.)

Psychology of Music: C. E. SEASHORE, Iowa, *chairman.* (11 papers.)

Race Differences: JOSEPH PETERSON, George Peabody College for Teachers, *chairman.* (5 papers.)

The Nature of G: CARL SPEARMAN, University College, London, *chairman.* (4 papers.)

Personnel Psychology: W. V. BINGHAM, Personnel Research Federation, *chairman.* (7 papers.)

Physiological Psychology: R. S. WOODWORTH, Columbia, *chairman.* (15 papers.)

Social Psychology: WILLIAM MCDOUGALL, Duke, *chairman.* (4 papers.)

Statistical Method: C. L. HULL, Yale, *chairman.* (8 papers.)

Sleep: H. M. JOHNSON, Simmons Investigation of Sleep, *chairman.* (9 papers.)

Esthetics: H. S. LANGFELD, Princeton, *chairman.* (15 papers.)

Mental Tests: M. L. REYMERT, Wittenberg, *chairman.* (28 papers.)

Motivation: H. A. CARR, Chicago, *chairman.* (5 papers.)

Reflexes: HULSEY CASON, Rochester, *chairman.* (13 papers.)

Religious Psychology: E. D. STARBUCK, Institute of Character Research, *chairman.* (11 papers.)

Sensation and Perception: H. P. WELD, Cornell, *chairman.* (6 papers.)

The morning sessions and symposia were all well attended, and there was considerable discussion, especially in the symposia, which proved to be an excellent arrangement for meeting the diversified interests of so large a group of scientists.

At the business meeting of the congress, it was voted to hold the Tenth International Congress in Copenhagen in 1932. The following members were added to the standing International Committee: *Brazil,* H. deB. B. Roxo; *Canada,* E. A. Bott; *Germany,* G. Kafka, D. Katz, O. Klemm, K. Lewin, W. Wirth; *Great Britain,* F. Aveling, Beatrice Edgell, L. Wynn-Jones; *Holland,* L. Bouman, A. A. Grünbaum; *Hungary,* P. Ranschburg; *India,* M. V. Gopalaswami; *New Zealand,* T. A. Hunter; *Poland,* S. Blachowski; *Russia,* I. P. Pavlov, A. B. Salkind, I. Spielrein, V. M. Borovski; *Switzerland,* J. Piaget; *United States,* J. R. Angell, W. S. Hunter, J. Jastrow, K. S. Lashley, E. L. Thorndike, Margaret F. Washburn, R. S. Woodworth. A telegram of condolence was sent to the widow of Morton Prince, who died a few days before the opening of the congress, and greetings to Professor Carl Stumpf and Professor G. Heymans, both of them former presidents of the congress.

Before the meeting, the foreign members visited Princeton and Columbia Universities, and at the close of the session they were given the opportunity of seeing Harvard, Clark, Smith, Wellesley and the biological station at Woods Hole. While at Harvard, they were shown the Psychological Laboratory, the Psycho-Educational Clinic, the Psychological Clinic and Fatigue Laboratory, the Medical School, the Psychopathic Hospital and the Judge Baker Foundation.

At the close of the congress, there was a general impression that never before had there been such a profitable exchange of views among psychologists from almost every country of the world, and the optimistic opinion was expressed that a real advance had been made in an international cooperation for the study of behavior.

PREACHING THE GOSPEL OF SCIENCE

By Dr. RALPH C. BENEDICT

BROOKLYN BOTANIC GARDEN AND HAAREN HIGH SCHOOL

READERS of SCIENCE are accustomed to have their attention focused mainly on exploratory work, investigation, as the most important means by which the advancement of science may be furthered. The pages of this journal are chiefly occupied with news relating to the scientists of the colleges and those of

research institutions, or with publication of articles by members of these groups. It is the purpose of this communication, however, to ask consideration for a different point of view: *viz.*, the problem of the broad diffusion of the facts of scientific discovery, old and new, and of the inculcation of habits of scientific thinking as a problem coordinate in importance with research. Indeed, the question might be raised whether, in a democratic government, the problem of diffusion is not at times the more important. Will it not be accepted as a truism that if a small fraction of the present body of knowledge were really apprehended by the mass of our citizens, progress in health and in economic status to an undreamed of degree would ensue? Is there any doubt, furthermore, that if the practice of dispassionate, unprejudiced thinking could be widely extended our social and international relations would be immeasurably improved?

The theses of this article are two: Diffusion of science, both content and method, can best be promoted through the multitudes of pupils in the secondary schools of the country. High-school teachers of science are the best agents for this diffusion. Is there any parent of a child, even in lower elementary grades, who has never experienced the shock of disputed authority—"My teacher says thus and so." With children in the high-school grades, the proportion of times when the teacher's contribution is better than the parent's is greatly increased.

There are four and a half million children in schools of high-school rank in the United States. This estimate is based on figures for 1926, furnished by the Bureau of Education, Department of the Interior, which reports 4,232,125 as the exact figure for that year, with an estimate of a 5 per cent. increase since then. A query put to a class in hygiene at Haaren High School, New York City, recently showed that the home population was over five times the school register for that particular class. That multiple would give the figure of over twenty-two million of our total population as "represented" in our secondary schools. Even if it is recognized that the multiple for the country as a whole is likely to be smaller, not more than four, it is still obvious that anything of importance which is accepted as valid by these millions of high-school pupils will in turn exert a constructive influence on many more in the homes, and that this will constitute an immense general influence.

The figures for the number of science teachers and of pupils in the science classes of the country are not available, but may be given in detail for New York City, thanks to a recent study and report made by John L. Tildsley.[1] The public senior high-school population comprises a total of approximately one hundred and fifty thousand. To this may be added the twenty-five thousand enrolled in the last year of the junior high school, which corresponds to the first year of the senior schools. Over ninety thousand of the total one hundred and seventy-five thousand are taking work in regular five-period-a-week science classes with a distribution in round numbers as follows: biology, 50,000; general science, 14,000; chemistry, 15,000; physics, 9,000, and physiography, 2,000. In addition, there are numerous thousands in hygiene classes, meeting once a week, and partly taught by biology teachers. When the health education plans of the state requirements are fully realized, these hygiene classes will at all times include half the total registry, *i.e.*, nearly ninety thousand.

The science classes are at present taught by a corps of nearly six hundred specially licensed teachers, distributed approximately as follows: biology, 320; general science, 80; chemistry, 105; physics, 60; physiography, 20. Exactly ninety-nine of the biology teachers are in the junior high-school division, figures for which are not covered by the Tildsley report. All but six of the senior high teachers are reported as having received at least a bachelor's degree, while over two hundred have M.A.'s and thirty have Ph.D.'s. In addition the same teachers reported additional graduate hours averaging two hundred and fourteen apiece, a total of 108,531 hours credit.

Extracting further from the Tildsley report, it may be noted that three hundred and twenty-two of the senior high teachers are members of one or more scientific societies, while one hundred and seventy-four are not members of any organization. It should be noted, however, that most of the memberships indicated are with the local physics, chemistry or biology teachers' organizations. Four hundred regularly read some scientific journal (including *Nature*, and other popular types); ninety-nine read none. As Tildsley remarks, these ninety-nine "are hardly likely to be welling springs of inspiration to their pupils," but he doubts "that the teachers of any other subject would excel this science group in training and professional attitude." It may be wondered how this group of science teachers would compare with a similar group of practicing physicians. It is clear that it is equally important for both groups to maintain close contact with the progress of science in their particular fields.

At present, the prospects for science progress in the New York schools are excellent. The central high-school administration is sympathetic and appreciative of the importance of science in the curriculum. The report of Dr. Tildsley, which was entitled "Teaching Science as a Way of Life," is already a most constructive influence. The New York public and the

[1] *High Points in the Work of the High Schools of New York*, 10: 1–186. October, 1928.

press are generally liberal, open-minded and interested in science. If the persisting obstacles of college-entrance preferences for languages could be surmounted, the prospects for an even wider diffusion of science as a body of fact and as a method would be greatly enhanced.

The professional interests of the science teachers are served locally by three principal organizations: the Chemistry Teachers' Club, the Physics Club of New York and the New York Association of Biology Teachers. The last mentioned has a paid membership of nearly four hundred, with a mailing list of nearly seven hundred. For several years the association has followed the policy of keeping on its mailing list every local science teacher or prospective teacher whose name could be obtained. To this list there are sent notices of the monthly meetings, together with occasional book reviews, etc. The purpose of the large list was to aid in the diffusion of science, but the policy has had the effect of nearly doubling the membership of five years ago.

The writer is chairman of a special committee of the Biology Association assigned to study the work of the various national scientific organizations with a view to advising local teachers of their aims, scope and publications. This committee includes as advisory members Professor R. A. Harper, of Columbia, and Professor E. W. Sinnott, of Barnard College. In this connection, a letter has recently been addressed to the presidents of the organizations relating to biology and science education and affiliated with the American Association for the Advancement of Science, asking information regarding conditions of membership, periodicals, etc. Of thirty letters sent out, answers have been received to all but four, and the material is in process of preparation for report to the local teachers.

This committee is urging that all New York science teachers should become members of the American Association and of as many others of the more specialized science societies as possible. It is recommended that for any given department, these memberships be scattered to cover a diverse group of organizations, thus bringing to each common departmental library a comprehensive series of periodicals.

The high school science teacher, whether in physics, chemistry, biology, general science or hygiene, has a continuing, unremitting responsibility for keeping abreast of current research. Scarcely a day passes without newspaper notice of some new discovery. Many of the stories are premature, often reportorially garbled through the desire to play up sensational "news." The fact that science is finding increasing space in the daily press places an especial responsibility on the science teacher to be prepared, either to give a prompt, well-founded judgment regarding any current item, or else to know certainly where to turn to find the basis for such a judgment. . . .

The high school science teacher is the intermediary through which these new contributions must find their most effective interpretation. Upon the attitude of the science teacher—whether broad-minded, progressive, well-balanced, of eager curiosity—will depend the attitude engendered in the minds of millions of high school pupils, and through them, in millions of homes. The diffusion of the stream of new discoveries, with all the hoped-for gains in the way of the health of the individual and community, of social betterment, and of race improvement, must take place through the secondary school system.[2]

Since the Tildsley survey of science teaching was made last June, there has been a considerable increase in the number of teachers enrolled in national scientific societies. During December, 1928, some thirty local biology teachers joined the Torrey Botanical Club, making a total of fifty local teachers enrolled in that organization. Probably most of these and some others became members of the American Association in anticipation of the New York meeting. More recently, in March, over thirty more have joined the American Genetic Association.

In Newtown High School, located in the borough of Queens and in the outskirts of the city, the biology department consists of seven teachers, all of whom are members of the American Association. In Haaren High School, half a block from Times Square, in the science department of ten teachers, comprising one in physics, four in general science and five in biology, the scientific affiliations are as follows:

Association	No. of members
American Association	5
Torrey Botanical Club	3
Botanical Society of America	1
American Genetic Association	2
American Fern Society	2
Ecological Society of America	1
American Eugenics Society	1
American Society of Mammalogists	1
American Geographic Society	3
American Nature Association	2
American Museum of Natural History	1
Brooklyn Academy of Arts and Sciences	1
Brooklyn Botanic Garden	1
National Education Association	1
National Audubon Society	1
N. Y. Ass'n. of Biology Teachers	8
Total	34

[2] Quoted from an article in the *Bulletin of High Points, etc.*, for March, 1929.

Among the nearly six hundred science teachers of New York's public high schools, distributed among some thirty-eight senior high and fifty-two junior high schools, membership in the American Association and in other scientific organizations is not generally as large as shown by the two schools cited above. However, there is good reason to believe that much of the apparent indifference has been due more to lack of information about scientific affiliations than to the lack of interest and professional attitude, and the two schools just cited are evidence to this effect. So far, the committee mentioned above has been chiefly concerned to promote membership in the American Association and its affiliated societies. It will be glad, now, to bring to the attention of the biology teachers any publications which have interest and pertinency in the fields of botany, zoology, human biology and hygiene. Furthermore, a copy of the most recent mailing list will be sent to the secretary of any biological organization or the editor of any biological periodical who would be interested to send sample copies or prospectuses of their work.

Finally the interest of the professional scientists of the country is asked in the problems of high-school science as a challenging opportunity and obligation. Too often the attitude of the college science teacher has even been obstructive and unsympathetic, especially with respect to college requirements. Promote the work of the high-school science teacher by welcoming him into your societies, by offering courses at times when he can take them, by speaking to the meetings of his special organizations.

Advances in science knowledge, in exploratory work, must naturally remain for the pioneer work of the few in the universities and research institutions, but the application of their discoveries in daily life, their extension among our one hundred and twenty million citizens, can best be attained by seeing to it that the four and a half million in the secondary schools receive a thorough training in the basic sciences. What does it matter that the scientist more and more effectively uses the methods of dispassionate analysis and synthetic constructive thought in discovering new facts if the general run of folk continue to think of disease and evolution, for example, so far as they think at all, in terms of ideas hundreds of years out-dated?

At present, high-school science must struggle for effective representation in high-school curricula with all the older subjects which hold their position tenaciously, mainly because of tradition. In an era in which science plays the important part that it does to-day, it would seem not unreasonable to suggest that a carefully determined sequence of science subjects be made the required core of the six years of the junior-senior high-school years, and that even English, as a mode of improving expression and appreciation, be relegated to a secondary position, in favor of science as the means of acquiring judgment and ideas to express. Is it not reasonable to forecast a future when men will look back at our time with wonder that young people could finish twelve years of public training with little or no real training in science courses?

SCIENTIFIC EVENTS

REPORT OF THE BRITISH COMMISSION OF FORESTRY

THE ninth annual report of the Forestry Commissioners says, according to the London *Times*, that the balance remaining in the Forestry Fund at September 30, 1927, was £406,103. Payments into the fund amounted to £627,092, and out of the fund to £648,936. Land acquisition during the year amounted to 43,953 acres, of which 32,056 acres were classified as plantable. Disposals amounted to 993 acres (981 acres plantable), thus reducing the net acquisition of plantable land to 31,075 acres. The total area of plantable land acquired to September 30, 1928, amounted to 275,913 acres, or 57,287 acres less than the proposed area. The area of state forests planted with conifers during the year was 21,496 acres, compared with 26,700 acres under the Acland Program, and 26,800 acres under the commissioners' revised program. The total to the end of the year was 110,910 acres, compared with 120,000 acres for the Acland Program and 119,700 for the revised program. The total area planted to September 30, 1928, was 116,676 acres. The planting program for the current season is 23,000 acres, and should this be fully completed, the total area planted by the commissioners in the ten years will amount to 139,676 acres.

The area proposed, under the Acland Report, to be afforested or replanted by local authorities and private owners with state assistance during the ten years was 110,000 acres, or an average of 11,000 acres per annum. By means of grants, 47,373 acres have been planted, 20,571 prepared for planting and 9,451 cleared of shrub. The systematic formation of forest workers' holdings was begun in the summer of 1924, and had therefore been running for four years at the end of the year under review. Up to September 30, 1928, 490 holdings had been completed (133 in the year under review), and 282 were in process of formation.

THE INTERNATIONAL TECHNICAL CONSULTING COMMITTEE ON RADIO COMMUNICATION

In the International Radiotelegraph Convention, adopted at the international conference held in Washington in 1927, provision was made for an International Technical Consulting Committee on Radio Communication. The general regulations adopted at the same time specified that this advisory committee should be formed, for each meeting, of experts representing either governments or private radio-operating companies. Meetings were to be held normally at two-year intervals, and the first one was to be convened by the government of the Netherlands.

In accordance with these agreements a meeting was arranged to take place at The Hague in September. American proposals for consideration at this meeting were prepared with great care by a joint committee of government and commercial radio engineers, acting under the auspices of the International Radio Advisory Committee. Subcommittees were organized to deal, respectively, with (1) frequency maintenance, (2) systematization of frequency allocation, (3) transmitter interference, (4) research organization, (5) definitions and ratings and (6) amateur licensing. Members of the bureau's staff have served as chairmen of three of these subcommittees.

Commercial companies in this country sent about ten representatives to the meeting, and the United States Government had three official representatives supported by four technical advisers. The three delegates were Major-General C. McK. Saltzman, member of the Federal Radio Commission; Major-General George S. Gibbs, chief signal officer of the Army, and Captain S. C. Hooper, head of the communication division of the Navy. The technical advisers include Dr. J. H. Dellinger and Dr. C. B. Jolliffe, of the Bureau of Standards.

The first essential for proper allocation and effective use of the radio-frequency bands available for communication is uniform and accurate measurement of the frequencies. The best method for comparing frequency measurements of various laboratories is the exchange of quartz piezo-oscillators. Consequently, in connection with this international meeting the bureau sent abroad a portable oscillator with thermostatic temperature control, on which measurements will be made at the national laboratories in France, Germany, Great Britain and Italy. Comparisons have already been made with the Bell Telephone Laboratories and the Naval Research Laboratory, so that the series of measurements abroad will serve to give a direct comparison between nearly all the laboratories in the world which are doing fundamental work on frequency measurements.

LAKE ERIE COOPERATIVE SURVEY

The United States Bureau of Fisheries steamer *Shearwater* was used on the cooperative survey of Lake Erie from May 15 to September 20, 1929. The organizations participating in the survey were the Bureau of Fisheries, the Ontario government, the states of New York and Ohio and the Buffalo Museum of Science.

The bureau provided the vessel and ship's force, the State of New York contributed largely to the maintenance of the survey, the Ontario government, the State of Ohio and the Buffalo Museum of Science contributed most of the special equipment and scientific personnel. The United States Coast and Geodetic Survey furnished hydrographic instruments and the hydrographer.

The extreme western end of the lake was covered by the State of Ohio and the Bureau of Fisheries. Except for this western portion, the entire lake was covered by the cooperative survey.

The scientific staff consisted of Dr. Charles J. Fish, director; Dr. Paul Burkholder, planktonologist; Arthur H. Louden, scientific assistant; C. J. Munter, chemist, and Lieutenant Chas. K. Green, hydrographer.

Four regular cruises were made, one each in the months of June, July, August and September. The cruises started on about the third of each month from Buffalo and terminated at Put in Bay about the eighteenth. All the fifty stations were occupied in each of these four cruises. The intercruise interval was utilized in special work and in steaming back to Buffalo for the next regular cruise. During the survey 4,435 statute miles were covered.

The limits of the cold bottom water in the vicinity of the Deep Hole were found to shift considerably with meteorological changes, and therefore the stations in this area were occupied on the intercruises as well as the regular cruises. Stops were made at eight ports on each cruise, and the staff was able to get the view-point of many commercial fishermen at the principal fishing ports. Most of the fishermen, as well as the staff, are of the opinion that the only solution to the Lake Erie fish problem lies in the establishment of uniform laws regulating the type and size of nets throughout the lake, of limiting the catch to the months in which there will be least interference with reproduction and increasing the number of fry released by the hatcheries.

THE FORESTS OF LIBERIA

G. Proctor Cooper, field assistant in tropical forestry at Yale University, has returned to New Haven after nearly a year's investigation of the forests of Liberia, West Africa. This work has been done by

the Yale Forest School in cooperation with the Firestone Plantations Company, which is establishing extensive rubber plantations in that republic. The clearing of large tracts of virgin timber afforded an opportunity for the study of the forest conditions which has never before been presented in West Africa.

Numerous sample areas were carefully laid out and all the trees were listed and measured. Hundreds of wood specimens were obtained together with leaves, flowers and fruits of the trees for botanical identification. Logs of 130 different species were hewed out and will later be tested for strength and other properties in the forest school laboratory. These logs represent every degree of hardness and color from white and punky "Corkwood" to the flinty "Red Ironbark." Boards of native manufacture will be tried out for their carpentry and furniture value. Since the Liberian forest is in many ways typical of the conditions found for hundreds of miles eastward the results will have a practical bearing on a vast region which is just on the threshold of unprecedented exploitation of tropical forests.

So little is known in America about the flora of West Africa that arrangements were made by Professor Samuel J. Record, who has charge of the tropical work at Yale University, to have the trees and other plants identified at the Royal Botanic Gardens, Kew, England. Three sets of herbarium samples have accordingly been shipped to England, one for Kew, one for the Natural History Museum in London and one for the Imperial Institute at Oxford.

The expedition also collected a series of birds from the tropical evergreen forest for Peabody Museum at Yale University. Mr. Cooper was assisted in this phase of the work by Mr. Rupert H. Drinkwater, of India, who is now in the British Camaroons continuing his ornithological investigations. As many of the birds have the same native names as the trees in which they live or whose fruit and seeds they eat, it is often a great help in locating the tree when the bird is seen in the bush.

A collection of the forest insects, mostly butterflies and beetles, is now at Peabody Museum awaiting study and classification. Dried barks, leaves, and fruits from 75 of the important trees used in native medicine and witchcraft are to be studied and analyzed by pharmaceutical chemists. Some of these plants contain very powerful and even deadly alkaloids which are used as poisons by the natives.

The Liberian wood specimens bring the total in the Yale collections to 16,000, representing 1,650 genera of 170 natural families. This is by far the most extensive assortment of woods in the world and nearly every country of the earth is represented. More than 2,000 samples, many very rare, have been added since the first of the year from the West Indies, Mexico, Central and South America, Japan, Siam, Java, New Caledonia, Papua, New Guinea, Norfolk Island, Australia, and all parts of Africa. Yale is cooperating with Oxford in an exploration of the forests of the Peruvian Amazon. The specimens are being systematically studied at the university and selected lots are sent to foreign institutions for special investigation.

THE PROFESSION OF ENGINEERING

THE American Engineering Council has appointed a committee on engineering and allied technical professions. The chairman is H. C. Morris, retired mining engineer, of Washington, D. C. Other members are: A. B. McDaniels, of Washington, representing the American Society of Civil Engineers; Conrad N. Lauer, of Philadelphia, the American Society of Mechanical Engineers; H. A. Kidder, of New York, the American Institute of Electrical Engineers; L. W. Wallace, of Washington, executive secretary of the American Engineering Council.

Committees from the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the Washington, D. C., Society of Engineers will work with the committee, whose findings, it is expected, will enable the council, organized ten years ago under the headship of Mr. Hoover, to enter upon a program of professional advancement. The announcement says:

> The committee will collect, tabulate, analyze and disseminate information concerning earnings of engineers. Such information will be so classified as to give a clear conception of the earnings of engineers in the several branches of the profession and also in various lines of endeavor, such as federal, state and municipal employment.
>
> For the purpose of suitable comparisons information will be obtained in so far as possible relating to the earnings of other professional men. The status of the profession as measured by appropriate standards will be ascertained, and the major trends of the profession determined. Dissemination of the facts revealed will be directed toward both engineers and the public.
>
> There will be classifications showing in which each type of engineer belongs, and a statement of the qualifications requisite to each classification. This is particularly needed in the federal government service.
>
> Registration of engineers prevails in some twenty states. This movement has had no guidance on the part of any major fraction of the profession. However, because of existing registration law, no adequate plan can be projected relating to the economic and professional status of the engineer without giving due consideration to the influences and trends of registration.

Such a survey as is contemplated will not fail to bring to light certain corollary questions, which will of necessity have to be pursued to some degree in order to get that breadth of comprehension necessary to an inclusive judgment and action.

On the basis of the information comprehended in this statement of aims, there should be opportunity to set up certain forward-looking and comprehensive objectives for the profession. Engineers are presumed to be analyzers and planners. It is therefore logical to believe that by analyzing the profession they would be able to formulate some major objectives for the profession to endeavor to realize in the years ahead.

ENROLMENT IN THE MEDICAL SCHOOLS

The U. S. Bureau of Education has issued a statement in regard to enrolment in the medical schools throughou the United States, according to which an investigation made in the fall of 1926 showed that the 8,500 individual applicants made altogether 20,093 applications, or each applicant on the average had applied to two and one half medical schools. Of the applications received 6,420 were accepted, but when the session began, only 5,020 students were actually enrolled, indicating that 1,400 students had applied and had been accepted by two or more medical schools. Thus, at the beginning of the college year 1926–27, there were 1,400 vacancies still existing, or one fourth of the entire first-year capacity. Fortunately, the medical schools had waiting lists, so that 989 of these vacancies were filled, as later reports showed that 6,009 students had been admitted. The report of the investigation stated also that of the 3,480 not accepted, 2,622 were rejected because of unsatisfactory qualifications.

The number of students graduating from medical schools during the past two years has increased from 3,962 to 4,262, an increase of 300 in the two years.

For the students who graduated in 1928, a special tabulation was prepared which gave the average age at graduation from the four-year medical course as 26.8 years. Or, counting the fifth year of hospital internship, the average age was 27.8.

Greatly enlarged plants at Columbia University and the University of Colorado medical schools have been completed within the past two years, as have also new buildings at Howard University and the State Universities of Iowa, Kansas and Tennessee and at the Johns Hopkins. Thus the capacity of medical schools is continually being increased, which is making it possible to enroll increasing numbers of medical students.

The United States has 149,521 physicians to its 118,127,645 population; this is a greater percentage (126.59 per 100,000 population) than that of any other country. However, this is a smaller number to each 100 square miles than in 18 other countries, but a larger number than in 22 other countries.

SCIENTIFIC NOTES AND NEWS

The William H. Welch Medical Library of the Johns Hopkins University and the Department of the History of Medicine are being dedicated on Thursday and Friday of the present week. The principal addresses are by Dr. Harvey Cushing, Moseley professor of surgery in the Harvard Medical School and surgeon-in-chief at the Peter Bent Brigham Hospital, and Dr. Karl Sudhoff, emeritus professor of the history of medicine at the University of Leipzig.

On Tuesday and Wednesday of this week the Wilmer Ophthalmological Institute of the Johns Hopkins University was dedicated. According to the program, it was expected that addresses would be made by Mr. Hubert L. Satterlee, president of the William Holland Wilmer Foundation, and by Mrs. Henry Breckenridge. In connection with the dedication, lectures were arranged by Professor Ernst Fuchs, of the University of Vienna; by Dr. George E. de Schweinitz, of the University of Pennsylvania, and by Sir John Herbert Parsons, of the University of London.

The Francis P. Garvan chair of chemical education at the Johns Hopkins University was dedicated on October 11 when in addition to President Ames and Mr. Garvan the speakers were Dr. John J. Abel, of the Johns Hopkins Medical School, and Dr. Irving Langmuir, of the General Electric Company, president of the American Chemical Society.

The Institute of Pathology of Western Reserve University was dedicated on October 7. The building is the gift of the General Education Board of the Rockefeller Foundation. The dedication program began at 1:30 P. M. with inspection of the building. Formal dedication was held at five o'clock in the Florence Harkness Memorial Chapel with the address by Dr. Henry R. Dean, professor of pathology of the University of Cambridge. At seven o'clock Dr. Robert E. Vinson, president, was the host at a dinner in Hayden Hall to delegates of universities and learned societies and to trustees of the university and of the university hospitals. Honor guests of the occasion beside Dr. Dean were Dr. William T. Councilman, of Harvard University; Dr. Ludvig Hektoen, of the University of Chicago, and Dr. Simon Flexner, of the Rockefeller Institute for Medical Research. Dr. Howard T. Karsner is director of the institute.

THE Moore Laboratory of Chemistry at Amherst College will be dedicated on October 25. The principal address will be given by Dr. C. E. K. Mees, director of the Eastman Kodak Company.

THE Lady Herdman Memorial Building for geology of the University of Liverpool will be opened by Mr. Stanley Baldwin on October 21.

THE seventh Josiah Willard Gibbs lecture will be delivered at Des Moines on the afternoon of Tuesday, December 31, by Professor Irving Fisher, of Yale University. This lecture is given under the joint auspices of the American Mathematical Society and of Section A of the American Association for the Advancement of Science. The subject will be "The Application of Mathematics to the Social Sciences." Professor Fisher was a colleague of Professor Gibbs. He started his teaching career as a tutor and later an assistant professor of mathematics at Yale. Some of his earliest publications were in the field of mathematics and his later economic works have been noted for their use of that science.

AMONG the honorary degrees conferred on the occasion of the centennial celebration of Illinois College were the degree of doctor of science on Dr. James Howard Brown, professor of bacteriology at the Johns Hopkins University; on Dr. Joseph A. Capps, professor of clinical medicine in the University of Chicago, and on Dr. Samuel W. Parr, professor of chemistry in the University of Illinois. The degree of doctor of laws was conferred on Dr. James Rowland Angell, president of Yale University.

DR. GEORGE FILLMORE SWAIN, of the engineering school of Harvard University, has been made an honorary member of the American Society of Civil Engineers.

THE doctorate of science was recently conferred by Beloit College on Dr. Walter V. Bingham, director of the Personnel Research Federation of New York City.

AT the forty-second meeting of the American Astronomical Society in Ottawa, the following new officers were elected: *Vice-president,* R. G. Aitken, 1929–31; *Secretary,* R. S. Dugan, 1929–30; *Treasurer,* Benjamin Boss, 1929–30; *Councilors,* E. S. King, 1929–32, F. H. Seares, 1929–32; *Members of Division of Physical Sciences, National Research Council,* S. A. Mitchell, 1930–33. It was decided to hold the next meeting, in December, at the Harvard College Observatory.

PROFESSOR ASAPH HALL, for many years astronomer at the U. S. Naval Observatory, has recently retired. He is making his home at Upper Darby, Pennsylvania, where he is actively continuing certain work, using the instruments at the Flower Observatory.

AT the University of Kentucky and Agricultural Experiment Station Dr. A. M. Peters, chemist, and Dr. Harrison Garman, head of the department of entomology and botany, have retired, both having reached the age of seventy years.

ANNOUNCEMENT is made of the retirement of Professor R. A. Cooley, State College, University of Montana, Bozeman, as head of the department of entomology, Experiment Station entomologist and state entomologist. After thirty years' service in Montana, at his own request he retires as head and continues as research professor in entomology and entomologist in the board of entomology. The release from executive duties will enable Professor Cooley to devote more attention to tick parasites in foreign countries and to their possible use in controlling the spotted fever tick in the northwest.

WILLIAM L. COOPER has been appointed director of the bureau of foreign and domestic commerce in the Department of Commerce to succeed Dr. Julius Klein.

DR. ROBERT B. GREENOUGH, assistant professor of surgery at the Harvard Medical School, was elected to the newly created office of chairman of the board of directors of the American Society for the Control of Cancer on October 9. The appointment of Dr. C. C. Little as managing director, which has already been reported, was confirmed.

THE London School of Hygiene and Tropical Medicine announces in the London *Times* that the transfer of Dr. J. G. Thomson to the Ross Institute will not take place. Dr. Thomson retains his appointment in the school as director of the department of protozoology.

PROFESSOR DR. B. ISSATSCHENKO has been elected chief of the department of general microbiology of the Institute of Experimental Medicine of Leningrad in succession to the late Dr. W. Omelianski.

THE following post-doctorate fellows have been appointed at the University of Pittsburgh: Hans du Mont, Ph.D., Greifswald, exchange fellow, and Chi Fang Lai, chemical engineer, National Institute of Technology, Peking, China.

DR. F. E. SMITH, director of scientific research at the British Admiralty since 1920, has been appointed secretary to the Committee of the Privy Council for Scientific and Industrial Research, in succession to Mr. H. T. Tizard, who recently resigned upon his appointment as rector of the Imperial College of Science and Technology, London.

DR. J. ALLEN SCOTT, of the school of hygiene and public health of the Johns Hopkins University, has accepted a position to do research work in the Public Health Laboratories at Cairo, Egypt.

J. W. BIGGER, professor of bacteriology and preventive medicine in Trinity College, Dublin, is spending October and November in Canada and the United States visiting the medical departments of the universities and hospitals under the auspices of the Rockefeller Foundation.

SCOTT TURNER, director of the United States Bureau of Mines, sailed from San Francisco on October 10 to attend the World Engineering Congress in Tokio, Japan, which will be held from October 29 to November 7. Following the appointment of President Hoover, then secretary of commerce, as honorary chairman of the World Engineering Congress for the United States, Mr. Turner was appointed by Mr. Hoover as one of the five federal engineers who are to represent the United States government at the congress.

THE American School of Prehistoric Research, of which Dr. George Grant MacCurdy, of Yale University, is director, will cooperate with the British School of Archeology at Jerusalem next April, May and June, in excavating three caves at the foot of Mount Carmel, near Athlit, Palestine. Dr. MacCurdy returned to New Haven on October 1 after conducting the ninth summer term of the school in selected portions of England, France and Spain. About half the term was devoted to excavating a rock shelter in Dordogne. Students attending the tenth summer term beginning the first of July, 1930, will have an opportunity to excavate not only in the Dordogne, but also in Spain.

DEAN L. E. CALL and Professor George A. Dean, of the Kansas State Agricultural College, left on September 23 to inspect the European corn-borer work in Ohio, Indiana, Michigan and Ontario. Dean Call and Professor Dean are chairmen of committees appointed by the American Society of Agronomy and the American Association of Economic Entomologists to study the investigational and control work on the corn-borer, and to report to their national societies.

AT the Minneapolis meeting of the American Medical Association in 1928 the section on the practice of medicine established the Frank Billings Lectureship Fund in view of the distinguished services which Dr. Billings has rendered to American medicine. The object of the fund is to provide a lecturer each year before the section. The trustees—Drs. Rollin T. Woodyatt, Chicago; James E. Paullin, Jr., Atlanta; Russell L. Cecil, New York; Warfield T. Longcope, Baltimore; Walter L. Bierring, treasurer, Des Moines—will endeavor to complete the fund within the next two years.

DR. BERGEN DAVIS, professor of physics at Columbia University, will lecture on October 24 before the Franklin Institute, Philadelphia, on "The Capture of Electrons by Swiftly Moving Particles."

AN Associated Press despatch reports that the meeting of the Italian Congress of Science opened at Florence on September 18. Scientific men from the United States who were present included Dr. Lauder W. Jones, professor of chemistry at Princeton University, and Dr. W. J. Robbins, professor of botany at the University of Missouri, who took part in the discussions. Among other visitors was General Perrier, president of the French Association for the Advancement of Science.

THE one hundred and fifty-ninth regular meeting of the American Physical Society will be held in Chicago at the Ryerson Physical Laboratory on Friday and Saturday, November 29 and 30. The one hundred and sixtieth regular meeting will be held at Stanford University on Saturday, December 7. If the length of the program requires it, there will be sessions on Friday, December 6.

THROUGH the efforts of the United States Fisheries Association the Bureau of Fisheries had an exhibit at the convention of that association in Atlantic City, N. J., on September 5, 6 and 7. The exhibit covered the following subjects: Net preservation, nutritive value and use of fishery food products and by-products, oyster culture or farming and tagging of fish useful in the study of the migrations of commercial species of fish. According to the *Fisheries Service Bulletin* a great deal of interest was shown in the exhibit, especially that part pertaining to the nutritive value and use of fishery food products and by-products in dietetics and animal nutrition. A map of the United States, prepared by the United States Public Health Service, showing the goiter belts, based on statistics obtained from the examination of 2,500,000 men for World War service, was shown, together with a mimeographed article for distribution explaining the necessity for including sea foods in the diet as a source of iodine in those regions of iodine deficiency. Interest in the bureau's exhibit was evidenced not only by those attending the fisheries convention but by physicians, dietitians, school teachers and other professional people from Atlantic City locally or from among guests at the various hotels, who came in large numbers to study the features of the exhibit from an educational and medical standpoint.

THE federal government's basic survey of the United States, which would require about 80 years at the present rate of progress, can be completed, according to a statement made by President Hoover which is reported in the *U. S. Daily*, within 18 years at an estimated cost of $1,000,000 annually under plans submitted by the Secretary of the Interior, Ray Lyman

Wilbur, and the Secretary of Commerce, Robert P. Lamont. The report on the government's surveys will be incorporated in estimates to be submitted to Congress by the Bureau of the Budget. These surveys are being made by the Coast and Geodetic Survey of the Department of Commerce and maps of the surveys by the topographic section of the Geological Survey, Department of the Interior. Secretary Wilbur and Secretary Lamont had submitted a plan for completion of the surveys within 18 years which will be incorporated in the estimates to be submitted to Congress by the Bureau of the Budget. It is proposed to expedite this work, which the President said he regarded as of very great economic importance, both to the various states and the federal government's activities, at a cost of $1,000,000 annually. About 43 per cent. of the accurate mapping has been completed by the federal government. It has taken 70 years to complete 43 per cent. of the work and the government does not want to wait 80 years to complete the remainder of the task. The President pointed out that if there had been adequate maps of the Mississippi River flood area it would have been possible to have saved 100,000 head of cattle at the time of the 1927 Mississippi flood.

THE new division of radiation and organisms of the Smithsonian Institution, the purpose of which is to study the exact dependence of the growth of plants and the health of animals on rays such as are received from the sun or from electric lamps, is making rapid progress. Four rooms in the west basement of the Smithsonian building, formerly used for storage, have been converted into laboratories, one of which is already fully equipped and in operation as a glass-blowing laboratory in charge of Mr. L. B. Clark. Special apparatus for the work, including photographic, electric and spectroscopic appliances, is being installed, and a growth chamber of special design for useful plants is being constructed. The offices of the division have been placed in the recently finished upper rooms of the flag tower, in which an elevator has been installed. The other rooms in the flag tower are being finished, and eventually there will be eight offices there where formerly there was nothing but storage rooms and a place for pigeons. The personnel of the division consists of Dr. F. S. Brackett, director; Dr. E. S. Johnston, of the University of Maryland, collaborator; Mr. L. B. Clark, laboratory assistant and technician, and Miss Virginia P. Stanley, stenographer.

UNIVERSITY AND EDUCATIONAL NOTES

BY the provision of the will of Miss Annie Clarkson, of New York City, Clarkson Memorial College of Technology of Potsdam, N. Y., receives outright $100,000. Mrs. W. A. Moore, Potsdam, N. Y., a sister of Miss Clarkson, is to have the income of the residue of the estate, conservatively estimated at $1,000,000, during her life, and at her death this is to be turned over to the Clarkson Memorial College of Technology. Mrs. Moore has decided to waive use of this sum and to turn over the amount to the college at once. By this double gift of the two Clarkson sisters the college will be able to move from the village of Potsdam to the beautiful Clarkson estate, which had already been given to the college by Miss Annie Clarkson.

A BEQUEST of $500,000 from Frank A. Champlin, who died recently in Los Angeles, has been made to Colby College, to be part of the permanent endowment fund of the college and to be known as the "James Tift Champlin and Mary A. Champlin Gift."

JOHN D. ROCKEFELLER, JR., has given $300,000 to the trustees of Hartford Seminary Foundation toward an endowment fund of $1,500,000.

A GROUND School in Aviation has been instituted at Union College, Schenectady, being carried on in cooperation with the Colonial Airways Corporation. The work is under the direction of the department of physics of Union College and part of it will be given there and part at the Colonial hangar of the Albany Airport.

THE department of anatomy of the University of Illinois College of Medicine announces the following new members of its staff: Dr. Franklin P. Reagan, associate professor, formerly at the University of Indiana; Dr. Arnold A. Zimmermann, assistant professor, formerly at Loyola University, and Dr. Gustav Zechel, instructor, formerly at the German university in Prague.

DR. C. Y. CANNON, head of the department of dairy husbandry at Brigham Young University, has been appointed head of the section of dairy husbandry at Iowa State College.

DR. E. C. ANGST has been appointed assistant professor of botany at the University of Oklahoma in charge of courses in bacteriology and cryptogamic botany. Rufus H. Moore has been appointed instructor in botany.

DISCUSSION

THE FRESH-WATER FAUNA OF NEW CALEDONIA

New Caledonia is a long and narrow island, far out in the South Pacific, some eight hundred miles from Australia. It is connected by relatively shallow water with the Loyalty Islands, which agree closely with it in the general character of the fauna, and doubtless was united with it at no very distant epoch. Otherwise, New Caledonia appears isolated, with a fauna and flora containing an enormous proportion of endemic forms. Thus, as recently as 1914 Professor R. H. Compton collected in the island (including the adjacent Isle of Pines) 830 species of flowering plants, of which 230 were new, including ten new genera. There are clear indications, supported by various kinds of evidence, that New Caledonia is part of an ancient land mass, and is to be classed with the "continental," not with the "oceanic" islands. It is also certain that the separation or isolation took place very long ago, perhaps in Mesozoic times, and it is probable that since that time there have been periods of elevation and depression, the former producing union with the not distant Loyalty group and with the still nearer Isle of Pines, the latter perhaps submerging all but the larger mountain masses. On all counts, the island is certainly one of the most interesting places for the biologist in the world, and although much work has been done on its biota, very much remains to be done.

The fresh-water fauna is necessarily somewhat limited, as the narrowness of the island, with a central mountain chain, causes the rivers to be small and short, while the sloping surfaces are unfavorable for the retention of bodies of water. It is therefore a land of creeks and small rivers, separated from one another by elevations. We naturally ask, does the fauna of these waters come down, variously modified, from the remote past when New Caledonia was part of a more or less continental area? Or has it, in various ways, come across the sea, or entered the rivers from the sea?

Max Weber and L. F. de Beaufort (1915) record numerous fresh-water fishes, but with one exception these are very widely distributed forms which undoubtedly came from the sea. They constitute a most striking illustration of the way in which fresh waters may be populated from marine sources, especially when there is no competing fauna of strictly fresh-water fishes.[1] The one exception is described as new, *Galaxias neocaledonicus,* apparently a very distinct species, with a peculiar long head. The genus *Galaxias,* including the so-called native trout of Australia and New Zealand, occurs in rivers of the southern hemisphere as far distant as Australia, Patagonia, the Falkland Islands and the Cape of Good Hope. This distribution, as Dr. Jordan remarks, has been held to support the idea of a great continent Antarctica, the remaining fragments of which still possess one of its most characteristic genera. However, several observers have noted that *Galaxias* runs in the sea, and a marine species has been found at the Chatham Islands. Hence we may infer that the New Caledonia *Galaxias* is not a remnant of continental connections, but a very old migrant from the ocean, now much modified.

A detailed review of the invertebrates would take too much space, but it is worth while to refer to some of the mollusca. In 1871 the French naturalist Crosse described a very interesting little shell which he called *Hemistomia caledonica.* It is minute, fusiform, with a large obliquely placed aperture. I collected it in some numbers in river drift near Bourail, along with other fresh-water shells. It constitutes an isolated genus curiously similar to some of the marine Rissoidae (for instance, *Rissoina,* well represented in New Zealand), and Mr. T. Iredale, of Sydney, in conversation, referred to it as a sort of fresh-water Rissoid. According to this view, it is derived from the sea, like the *Galaxias,* but at a period so remote that it has evolved into a distinct genus. The alternative opinion, supported by the current literature, is that it belongs to the Amnicolidae (Hydrobiidae), and is related to *Potamopyrgus* of Stimpson, which includes all the fresh-water Rissoa-like shells of New Zealand, species in Australia and Tasmania, and in South and Central America, going as far north as Texas. There is even a species described from West Africa, but the accuracy of the locality is not wholly beyond suspicion. Finally, *Hemistomia* is not without a certain resemblance to the African fresh-water group Syrnolopsidae.

New Caledonia is very rich in species of the genus *Physa,* and those I collected have a very ordinary appearance so far as can be seen from the shell. But *Physa* is known from the Mesozoic, and there is apparently no reason why the genus should not have existed in New Caledonia from the time of its origin as an island. We regret that it is impossible to examine the anatomy of the long extinct species, but perhaps indirectly we may do so in certain cases. That is, if we are satisfied that insular species have remained isolated since a given geological period, the anatomical features they possess in common with those of other regions must apparently (or very probably) have existed in the common ancestors, to-day only known as fossils. The importance of the

[1] Even in northern Siam, very far from the sea, I found in the Nan River at Nan a fish of marine affinities, *Tetraodon leiurus* (Bleeker); the species determined for me by Dr. J. T. Nichols.

anatomy is shown by the fact that on investigating the soft parts certain apparent species of *Physa* of the Hawaiian Islands turned out to be sinistral forms of the *Lymnaea* type. One of the New Caledonia species, *Physa varicosa* of Gassies, has been referred to *Bulinus*, which has nothing to do with true *Physa*. Thus the whole *Physa* fauna needs reinvestigation.

The recorded fresh-water bivalves include a remarkable endemic species, *Cyrena sublobata* Deshayes, and certain species of *Batissa*. It turns out that the latter were reported in error; the genus exists in the Fiji Islands, but not in New Caledonia. We must now add a quite different type of shell, belonging to the mytiliform (mussel-like) groups. These mollusks mostly inhabit the sea, but derived from the marine stock, and now very widely distributed in fresh waters, is the family Driessenidae.[2] They exist in Europe, Africa, America and, according to Dall, China and the Fiji Islands. Typically marine are the Mytilidae, represented by the common mussel of our coasts. But the genus *Modiolus* has fresh-water species in Asia, and *M. fluviatilis* (Hutton) occurs in brackish water throughout New Zealand. The related genus *Modiolaria* is marine, but I found a species common in river drift near Bourail, New Caledonia. In New South Wales *Modiolaria subtorta* Dunker is found in fresh or brackish water, but it is so distinct that Iredale has made it (1924) the type of a distinct genus, *Fluviolanatus*. When, in the Australian Museum at Sydney, I showed Mr. Iredale my New Caledonia *Modiolaria*, he produced another fresh-water species from that island, collected by Brazier in the La Foa River! This is quite distinct from mine, being in fact a *Fluviolanatus*. Mr. Iredale kindly gave me a specimen; he will later describe the species. My species, which I will call *Modiolaria bourailensis* n. sp., has a general superficial resemblance to *M. varicosa* Gould, a marine shell found at Sydney. It is, however, quite different, being like *Fluviolanatus* in lacking the sculptured ribs, and in having the beaks less terminal. In place of the sculptured ribs, running to the posterior end, is a pattern simulating them, of straight pale red rays alternating with straw-yellow ones. This is superimposed on a pattern (also seen in *M. varicosa*) of vertical curved or zigzag brown bands at rather wide intervals. The shell is thin, with a pale yellow epidermis, not at all produced into bristles. The upper margin is elevated and obtusely angulate in the middle, a feature quite lacking in *Fluviolanatus*, but somewhat indicated in the broader and (anteroposteriorly) shorter *M. varicosa*. Looking at the shell from within, the beaks are much less prominent than in *Fluviolanatus*. The anteroposterior diameter is about 10 to 11 mm; dorsoventral about 5.3 mm; thickness about 3.2 mm. The upper margin, from the beaks to the highest elevation, is tuberculate within, the tubercles being smaller, much closer and more numerous than in *M. varicosa*. There is no trace of a myophore, such as exists in *Congeria*. The shells were found in numbers in river drift, with many other fresh-water and land shells, close to the sea. The question arose whether they could possibly have been blown from the sea-beach. This idea must be rejected, as there is no such marine species known in the region, and the material was intimately mixed with the river drift. The thinness of the shells suggests life in fresh water.

[2] For the spelling, see Pilsbry and Bequaert, "Aquatic Mollusks of the Belgian Congo," 1927.

T. D. A. COCKERELL

UNIVERSITY OF COLORADO
AUGUST 28

ATMOSPHERIC ELECTRICITY DURING SANDSTORMS

IN the issue of SCIENCE for May 3 appeared a note by R. H. Canfield regarding "Atmospheric Electricity during Sandstorms." Phenomena very similar to those described have repeatedly been observed here in our physics laboratory. A number of times during sand storms I have connected our radio transmitting aerial through a galvanometer to earth, and find that there is a more or less continuous flow of current from aerial to earth. The strength of current in general seems to correspond to the violence of the storm, sometimes exceeding twenty micro-amperes. Our aerial is of the triangular flat top variety supported by steel masts forty feet above the roof of the laboratory and very well insulated.

An undamped electrostatic voltmeter of very short period if connected to the aerial during a storm is set into vigorous vibration indicating a rapidly fluctuating potential of more than 20,000 volts. This is to be expected because of brush discharge from the lead in wire. During one storm while the discharge flowed through the galvanometer the needle indicated a reversal of the direction of discharge a number of times though each time for an instant only. I was somewhat surprised to find the aerial potential drop to almost zero before the first drops of rain fell and the first flash of lightning. During the thunderstorm that followed the potential of the aerial remained undisturbed at zero.

It has been suggested that this phenomenon is due to triboelectricity, but it is interesting to find that on a perfectly still day when the air is heavily laden with dust the aerial potential may fluctuate for hours between 5,000 and 10,000 volts, though if earthed through a galvanometer the current amounts only to about one micro-ampere.

Self-recording apparatus is being constructed which we hope will prove useful in a more detailed study of the matter.

J. M. BENADE

FORMAN CHRISTIAN COLLEGE,
LAHORE, INDIA

THE PHYSIOLOGY OF THE SINGING VOICE

WITH Miss Minnie K. Willens, of the graduate department of the University of Denver, I have made preliminary studies on the physiology of the voice with special reference to the relation of the respiratory mechanism to the voice mechanism in the formation of tone. The study indicates that the respiratory muscles, in addition to their rôle of providing a moving column of air to be interrupted by the vocal mechanism in the formation of the voice, are important synergists of the intrinsic and extrinsic muscles of the larynx in tone formation, and that the maximum tone range and the optimum tone quality are attainable only by utilization of such synergistic action. This conclusion is at variance with the accepted practice of vocal instructors of encouraging the use of a single type of breathing—the costo-diaphragmatic. The later type of breathing has been favored and assumed to be the best because it produces the greatest vital capacity, involves a minimal respiratory rate for a definite volume of air, and supposedly reduces respiratory fatigue as a consequence. However, fatigue of the powerful respiratory muscles is a very remote contingency in singing, whereas strain and tiring of the delicate musculi vocales (thyroarytenoides) is a very frequently observed phenomenon. The employment of different types of respiration for different tone ranges—*viz.*, chest breathing for the higher tones, costo-diaphragmatic breathing for the intermediate tones and abdominal breathing for the lower tones—minimizes the strain upon the laryngeal musculature by altering the relative position of the shoulder girdle to the upper attachments of the larynx, the base of the skull, the lower jaw and the spine, and thereby alters the tension and tonus of the various groups of laryngeal muscles involved. Moreover, singing in this manner results in improvement of tonal range and quality and of vocal resonance. Complete results of the study will be published in the future.

E. M. JOSEPHSON

993 PARK AVENUE,
NEW YORK, N. Y.

A POPULAR FALLACY ABOUT HARDNESS

THERE appears to be a popular idea that a softer substance constantly rubbed over a harder one will in time wear the harder one away. Nearly any cigar store clerk will tell you this in explaining how his glass counter has become so thoroughly scratched up that the cigars can not be seen beneath it. A casual examination will show that such a surface is produced by an accumulation of definite scratches which no copper, silver or nickel coin can make. It is true that where most scratches are made most coins are passed, but at the same place most sand grains, dust particles and ring settings are also rubbed against the plate glass of the counter.

A. S. FURCRON

WESTERN RESERVE UNIVERSITY

THE PREPARATION OF CHARTS FOR REPRODUCTION

IN the making of charts and graphs which are to be reproduced in publications, it is always desirable to make certain that the smallest details such as lettering, character of lines where several curves are shown on the same coordinates, etc., will show clearly when reduced to the size of journal illustrations. Likewise, when one wishes to place several charts on the same page of text, it is necessary to know how much reduction can be made with safety to the small details. The following rough-and-ready method will give this information without the labor of making measurements and computations:

Pin the chart to the wall. With a foot or so of twine in your hand, back away from the chart to the furthest point from which the smallest detail is clear. Hold the string at the level of your eyes at reading distance from them and parallel to the wall. Fixating the chart, move your hands apart on the string until your two thumb-nails are tangent to the vertical borders of the chart. Measure the length of string between your thumb-nails, which will be the minimum width the chart may have after it is reduced for publication.

GORDON L. WALLS

UNIVERSITY OF MICHIGAN

ORGANIC SYNTHESES

THE board of editors of *Organic Syntheses* (an annual publication of satisfactory methods for the preparation of organic chemicals) has decided to collect, revise and rearrange the preparations described in the first nine volumes in such a way as to make them more suitable for general use in synthetic organic chemistry. All these preparations are to be published in a single comprehensive volume to be designated as the "Collective Volume—Revision of Volumes I–IX."

In this work of revision we would greatly appreciate suggestions in the way of corrections, difficulties in checking, new and improved methods, etc.

HENRY GILMAN

IOWA STATE COLLEGE

SCIENTIFIC BOOKS

Organographie der Pflanzen Insbesondere der Archegoniaten und Samenpflanzen. By Dr. K. GOEBEL. Erste Teil—Allgemeine Organographie. Dritte Umgearbeitete Auflage. G. Fischer, Jena, 1928. 642 pp., 621 text-figures.

THIS is a day of early specialization of research in narrowly restricted botanical fields, often by workers who have had but a year or two of introductory courses covering the general field. At such a time the comprehensive discussion here presented by von Goebel of the structure, the space relations and ontogenetic development of plant organs, as well as that of their correlations in function, should prove a broadening and steadying influence of much importance, on botanical investigators in many fields. It is of value not merely to the plant organographer and physiologist, but is of still more value perhaps to the experimental morphologist and to the plant pathologist, the latter of whom more often than not lacks the sort of knowledge of the structure, behavior and interdependence of the plant's organs under normal conditions that can be gained from von Goebel's book. Nowhere else in modern botanical literature can the botanist turn for so authoritative a general treatment of the whole subject of plant organography.

This volume—"Allgemeine Organographie"—with the two or more special volumes on bryophytes, pteridophytes and spermatophytes that are to follow, will constitute a compact encyclopedia of the main features of plant organography, largely observed or verified by von Goebel and his students, during a half century of unusually prolific botanical research. Beyond this, von Goebel's interpretations of the significance of the different structures and the different types of development described are suggestive and stimulating, and may at times indeed be provocative of keen disputation. In the "Organographie" we not only become acquainted with a whole series of observations that are of interest to the causal morphologist, but find many which are also of direct concern to the horticulturist and orchardist.

As compared with the second edition of this "General Organography" this third edition is enlarged by 139 pages and by 160 additional figures. Three fourths of the new pages and ninety-one figures have been added to Chapter III, "Die Symmetrieverhältnisse der Pflanzen." Most of this added space is devoted to a series of new paragraphs on polarity in the spores and sporelings of the thallophytes and in the spores and embryos of archegoniates and seed plants. About twenty pages each have been added to Chapter II, "Organbildung auf den verschiedenen Stufen des Pflanzenreichs," and to Chapter VI, "Die Abhängigkeit von Organbildung von inneren und aüseren Faktoren."

This volume, like its earlier editions, is noteworthy for its illustrations. Many of these are drawings or photographs made by von Goebel himself in far corners of the earth, and they illustrate very aptly the subjects discussed in the book. Other figures are clear diagrammatic presentations of interesting features of the spatial relations of organs, or of the comparative development of the same part in different related species, as, for example, in the instructive figures 40 and 41, which show the shifting of the region of most active growth in the floral axis of certain Rosales. Altogether more than five sixths of the excellent illustrations in this volume (504 of a total of 621) are original with the author. Many of the remaining figures were made by students in Goebel's laboratory.

Shortcomings may be pointed out in the "Organographie" by the cytologist or the plant anatomist who is seeking physical or biochemical explanations of the origins of plant organs and plant tissues. It is true, nevertheless, that he will find recorded here a large number of significant observations regarding the effect on the structure attained by the mature plant, of the inherent qualities of the plant itself and of the various environmental influences that may stimulate or inhibit its development. Many unsolved problems also are here either clearly stated or in other cases roughed out, ready for immediate attack by the trained worker prepared to apply to them the conceptions and the methods of the physiologist, the biophysicist and biochemist for their more or less proximate solution.

DUNCAN S. JOHNSON
JOHNS HOPKINS UNIVERSITY

SPECIAL ARTICLES

PHOSPHORUS COMPOUNDS OF MUSCLE AND LIVER

I. MUSCLE

EMBDEN and Schmidt[1] have recently made the highly interesting discovery that the adenosine phosphoric acid isolated about two years ago from voluntary muscle[2] is not identical with that obtained from yeast nucleic acid. Among the chemical properties by which the two may be distinguished the difference in resistance to hydrolysis by acid is particularly striking. The muscle nucleotide ("myoadenylic acid") is hydrolyzed (by 0.1 N sulphuric acid at 100°) only

[1] G. Embden and G. Schmidt, *Z. physiol. Chem.*, 181: 130, 1929.

[2] G. Embden and M. Zimmerman, *Z. physiol. Chem.*, 167: 137, 1927.

about one fifth as rapidly, as measured by the rate at which o-phosphoric acid is split off.[1]

That adenine (in nucleotide combination) is the source of the ammonia formed in muscle during contraction has been amply demonstrated by Embden and his collaborators. The physiological significance of this important work is presumably quite unaffected by the fact, which we now have to report, that myoadenylic acid is not a normal constituent of muscle (except perhaps in traces), but a decomposition product. Our first intimation that this might be the case developed from the observation that when a protein free muscle filtrate is treated with an alkaline solution of calcium chloride[3] a large part of the purine nitrogen comes down in the precipitate. The calcium salt of myoadenylic acid is soluble in water, and should consequently—if present—remain dissolved under these conditions.

The purine derivative precipitated by calcium has been isolated by (1) precipitation with mercuric acetate in the presence of 2 per cent. acetic acid, followed (after removal of the mercury) by (2) precipitation with calcium chloride and alcohol from hydrochloric acid solution, which yields an acid calcium salt. By repeating the entire process the acid calcium salt is finally obtained as a microcrystalline precipitate. The yield is not far from quantitative, and accounts not only for most of the purine nitrogen of muscle, but also for most of the acid soluble phosphorus not present as o-phosphoric acid, phosphocreatine or hexose monophosphate. In the case of cat muscle the yield of purified material may be the equivalent of nearly 50 mg of phosphorus per 100 gm of muscle.

The acid calcium salt is not well suited for analytical purposes, owing to the difficulty of removing all the water. It may, however, be converted to a silver salt—by precipitation with silver nitrate from nitric acid solution—and the composition of this product has been found to be $C_{10}H_{13}O_{13}N_5P_3Ag_3$. It contains, in addition to adenine and carbohydrate, three molecules of phosphoric acid, or two more than in adenylic acid. Two of the three molecules of phosphoric acid are readily removed by hydrolysis with acid, and this fact is doubtless sufficient to explain why Embden and Zimmerman[2] obtained a nucleotide (myoadenylic acid) which still retains the one resistant phosphoric acid group.

The new substance includes also the phosphorus which Lohmann[4] believes to be present in the muscle in the form of pyrophosphate, but whether or not it is an ester of pyrophosphoric acid remains to be determined.

[3] This is the first step in the isolation of phosphocreatine (C. H. Fiske and Y. Subbarow, *J. Biol. Chem.*, 81: 629, 1929) where it serves the purpose of removing inorganic phosphate and other products.

[4] K. Lohmann, *Biochem. Z.*, 202: 466, 1928; 203: 164, 172, 1928.

II. Liver

The greater part of the organic acid soluble phosphorus of liver may be precipitated from the protein free filtrate, after removing the inorganic phosphate with alkaline calcium chloride solution, by the addition of alcohol. Purification by dissolving in water and reprecipitating with alcohol finally yields a calcium salt, crystallizing in spherulites or aggregates of short needles, and having the composition $C_3H_7O_6PCa.1\frac{1}{2}H_2O$. It is the calcium salt of glycerophosphoric acid, which in spite of text-book statements has not—as far as we have been able to determine—been isolated from animal material before, at least under conditions which preclude its formation from lecithin and related substances.

Experiments are now under way which it is hoped will lead to some procedure for the quantitative estimate of free glycerophosphate in tissue filtrates. From present indications this substance appears to account for at least one third of the total acid soluble phosphorus of the liver.

The properties of the above-mentioned calcium salt, together with the fact that it gives an intense greenish blue color on applying the Denigès codeine test after oxidation with bromine,[5] and forms no insoluble double salt with barium nitrate,[6] identify it as α-glycerophosphate. This is of particular interest since all preparations of lecithin so far examined by means of these tests have been found to contain mainly the β form of glycerophosphoric acid.[7]

Cyrus H. Fiske
Y. Subbarow

Biochemical Laboratory,
Harvard Medical School

[5] O. Bailly, *Ann. chim.*, 6: 96, 1916.

[6] P. Karrer and H. Salomon, *Helv. chim. acta*, 9: 1, 1926.

[7] O. Bailly, *Ann. chim.*, 6: 215, 1916; P. Karrer and P. Benz, *Helv. chim. acta*, 10: 87, 1927.

BALANCED FERTILIZERS AND LIEBIG'S LAW OF THE MINIMUM

Liebig maintained that "by the deficiency or absence of *one* necessary constituent, all others being present, the soil is rendered barren for all those crops to the life of which *that one* constituent is indispensable."[1] This afterwards became known as the "law of the minimum," from which it must logically follow, as indeed Liebig himself announced,[2] that

[1] Justus Liebig, "Chemistry in Its Applications to Agriculture and Physiology," third edition, 1843.

[2] Justus Liebig, "Les lois naturelles de l'Agriculture," 2, second chapter, 1863.

nutrient elements are absorbed in certain definite proportions ("chiffres proportionals") in such a manner that a limit having been reached by one, the absorption of the others is retarded (depressed) *ipso facto*.

Accordingly, if with time as the abscissa and the quantity of nutrient element absorbed during the growth of a plant as the ordinate, graphs are plotted indicating the course of absorption of the three principal fertilizer constituents, nitrogen, phosphorus and potassium, from a soil to which a "complete" fertilizer has been added, it will follow from Liebig's basic assumption that, with all other growth factors constant, the graph showing the course of absorption of *any one* of these elements from a fertilizer containing only two of them would be displaced from its former position and will now fall below it.

The observed facts, however, were not always in harmony with Liebig's hypothesis. For example, from Liebig's assumption it should follow that the relationship between the supply of a particular plant nutrient and the dry matter produced would be one of simple proportion, and indeed this was Liebig's conception.[2] But this is not the case,[3, 4, 5] for the curve of dry matter produced plotted against nutrient supply is sigmoid in shape and not a straight line having the x and y coordinates equal to one another as would be expected if Liebig's deduction held true.

Liebscher[6] suggested the substitution of his "law of the optimum" for the "law of the minimum." In effect, this is that the plant "is able to utilize to a greater extent that growth factor present in minimum amount the more the other factors already present approach toward their optimum values." But since water was the only growth variable tested by Leibscher, generalizations are hardly possible.

A few years later Mitscherlich[7] announced his "Gesetz der physiologischen Beziehungen," according to which any one individual growth factor can, independently, increase the growth of all others, provided it is not already present in optimum amounts. Mitscherlich's "law" has been variously interpreted. Some authorities have argued that it furnishes additional support for Liebig's "law of the minimum" and others consider that Liebig's and Mitscherlich's views are irreconcilable.

It has been argued[8] in favor of the retention of the "law of the minimum" that as shown by the experiments of Henrich,[9] Langer[10] and Lemmermann[8] certain applications of the "law" have been of value in explaining to the farmer certain basic principles of manuring.

No direct proof, however, against Liebig's "law of the minimum" has been forthcoming until Lagatu and Maume,[11] of l'Ecole Nationale d'Agriculture de Montpellier, in a series of brilliant investigations begun in 1919, showed that the course of absorption of nitrogen, phosphorus and potassium in the vine was irreconcilable with Liebig's "law." Owing, possibly, to the inaccessibility of some of the journals in which these investigations have been published, they have, unfortunately, passed unnoticed in this country.

The investigations have centered upon the analysis of the leaves of vines from experimental plots treated with "complete" fertilizer (N, P and K) and with combinations in which one of each of the elements is absent. Plots having no fertilizer applied serve as controls. Analyses with respect to N, P and K were made at regular intervals from May to October of each year. They have found the following striking results:

(1) The application of an "incomplete" fertilizer deficient in one of the elements N, P or K results in an *increased absorption by the plant of the other two*.

(2) This lack of balance in a fertilizer containing two only of the principal fertilizer constituents (N, P, K) may be so great that the relative excess of these elements will "act as a brake" on the absorption of the one omitted to such an extent that *the plant will absorb from the soil containing this "incomplete" fertilizer less of the missing element than it would from the soil containing no fertilizer additions.*

(3) A lack of nutritional balance resulting from the addition of an unbalanced fertilizer results (except in the case of N deficiency) in decreased yields. This exceptional behavior of nitrogen is explained on the basis that this constituent is utilized more by the leaves than by the fruit (grapes). Development of the stems and leaves, however, will be retarded.

[3] A. Hellreigel and H. Wilforth, *Ztschr. des Vereins f. d. Rübenzucker-Industrie*, 1888; *Arb. Deut. Landw. Gesell.*, 34: 18, 1898.

[4] H. Weissmann, *Ztschr. Pflanzenernähr. u. Düngung*, 2A: 1–79, 1923.

[5] E. J. Russell, "Soil Conditions and Plant Growth," p. 36, fifth edition, 1927.

[6] G. Liebscher, *Jour. für Landw.*, 43: 49–216, 1895.

[7] Alfred Mitscherlich, *Landw. Jahrbücher*, 56: 71–92, 1921.

[8] O. Lemmermann, P. Hasse and W. Jensen, *Ztschr. Pflanzenernähr. u. Düngung*, B7: 49–98, 1928.

[9] R. Henrich, "Dünger und Düngen," Preisschrift, p. 2, third edition, 1896.

[10] L. Langer, *Jour. für Landw.*, 49: 209–229, 1901.

[11] H. Lagatu, "Rapport présenté au Congrès d'Agriculture régionale du Sud-Ouest," Toulouse, Mai, 1922, pp. 3–21; "Communication au Congrès de l'Association française pour l'avancement des Sciences," Montpellier, *Juillet*, 1922, pp. 22–31; *Compt. Rend.*, 172: 129, 1921. H. Lagatu and L. Maume, *Compt. Rend.*, 179: 782, 1924; *ibid.*, 179: 932, 1924; *ibid.*, 180: 1179, 1925; "Communication au Congrès des engrais azotés de synthèse à Montpellier," Juin 1, 1927, pp. 1–15; Extrait des *Compt. rend. l'acad. d'agric. France*, Avr. 6–Mai 11, 1927, pp. 1–24; *ibid.*, Juin 13, 1928, pp. 1–15; "Communication faite le 22 Juin, 1928, à Bordeaux au Congrès intern. du vin et du pin maritime," pp. 1–12.

Both (1) and (2) above are contrary to Liebig's "law." Lagatu and Maume's results show that whatever effect the absence of an element from a fertilizer has on the yield, *it is not due to a depression of absorption of the other elements, but, on the contrary, to a nutritional lack of balance due to increased absorption of the remaining elements.*

It will be of interest to know if the remarkable results obtained by Lagatu and Maume in the case of the vine will be found to be true also for other plants. This point is now under examination for apple-trees grown under controlled conditions.[12]

Walter Thomas

Department of Agricultural and Biological Chemistry, Pennsylvania State College

EXPERIMENTAL INFECTION OF RATS WITH THE BALANTIDIUM FROM THE PIG[1]

The following observations were made during an attempt to obtain an experimental infection of *Balantidium* in the rat, in order that some of the relations of this parasite to the diet of the host might be studied.

So far as the available literature shows, no previous attempt has been made to infect rats with the *Balantidium* from the pig. Pritze (1928)[2] says that Nöller (1926)[3] has raised the question as to whether or not the *Balantidium* of the Norway rat may have been acquired from the pig. Nöller's article has not been available, but with its exception it appears that no *Balantidium* has ever been noted in the rat. Scott (1927)[4] listed thirty-two species of this genus but not one of them from the rat.

Experimental infections of the *Balantidium* from the pig have been established in the monkey by Brumpt (1909),[5] by Hegner (1926)[6] and Rees (1927)[7] in the guinea-pig. According to Hegner (1927),[8] Ohi (1923)[9] was unable to infect the guinea-pig, rabbit and dog with pig material.

At the suggestion of Dr. H. L. Ratcliffe, 0.5 cc of a culture of the *Balantidium* from the pig, concentrated by centrifugation, was injected into the cecum of a rat, after laporatomy. This rat had been fed a stock diet, high in carbohydrate content, to which was added carrots. Examination of the cecum of this rat, which was killed two days later, revealed many balantidia, all trophozoites, including some dividing forms.

Attempts were made to infect a number of rats. Two methods were used and the material was derived from two sources. The first was to inject into the cecum of laporatomized rats under aseptic conditions, trophozoites of *Balantidium*, either from cultures which had been concentrated by centrifugation, or from the colon of the pig. In the second method, material from the colon of the pig was strained through cheesecloth. Rats were given five or six cubic centimeters of this strained liquid material by stomach tube. Material of this sort was used in the first method.

Results obtained by the two methods were as follows:

Source of material	Method of injection	No. animals injected	Positive for *Balantidium*	Negative for *Balantidium*
Cultures	Intracecal	22	9	13
Colon of the pig	"	14	2	12
Colon of the pig	Stomach tube	12	8	4
Total		48	19	29

These infections lasted from two to twenty-three days. Some of the rats were killed before examination which showed them to be positive, and it is quite probable that, had these rats been examined by operation and allowed to live, the infections would have persisted for a longer time.

The parasites were localized in the cecum of the rat. Dividing forms were found frequently. Daily examination of pellets obtained from the rectum of two rats, which were known to be positive, when carried on over a period of five days, failed to show any cysts. On one occasion trophozoites were found in a soft, mushy pellet.

Attempts to infect four rats with the cysts of *Balantidium* from the monkey were negative. Negative results were obtained in an attempt to infect four rats with the *Balantidium* from the guinea-pig.

E. Schumaker

The Johns Hopkins University

12 W. Thomas and R. D. Anthony, *Proc. Am. Soc. Hort. Sci.*, pp. 81–87, 1926.

1 From the department of protozoology, Johns Hopkins School of Hygiene and Public Health. This work was aided by a grant from the committee on scientific research of the American Medical Association.

2 F. Pritze, 1928, *Zeit. f. Parasitenkunde*, 1: 345–415.

3 W. Nöller, 1926, "Tierheilk. u. Tierzucht.," pp. 88–95.

4 M. J. Scott, 1927, *Journ. Morph. and Physiol.*, 44: 417–453.

5 E. Brumpt, 1909, *C. R. Soc. Biol.*, 67: 103.

6 R. W. Hegner, 1926, *Amer. Journ. Hyg.*, 6: 593.

7 C. W. Rees, 1927, Science, 66: 89–91.

8 R. W. Hegner, 1927, "Host-Parasite Relations Between Man and His Intestinal Protozoa." New York. 184 pp.

9 T. Ohi, 1923, *Taiwan Igakkai Zasshi*, 229: 19–20.

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SCIENCE NEWS

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THE EFFECT OF DIET ON DENTAL DEVELOPMENT

THE development of teeth, both as to speed of growth and structure, is greatly influenced by diet, studies reported to the American Dental Association by Drs. E. V. McCollum and Henry Klein, of the Johns Hopkins School of Hygiene and Public Health, have shown.

Teeth of swine fed on a deficient diet, such as would cause rickets in rats, developed more slowly and were poorer in structure and position than teeth of swine of the same age that had been fed a normal, balanced ration. A remarkable difference in size of teeth and lower jaw-bone was found in the animals as a result of the differences of diet.

The food of the low calcium diet was softer and less abrasive to the finger touch than that of the normal and high calcium diets, yet the teeth of animals fed the low calcium diet were ground down almost to the gum margin. This is further evidence pointing to the faulty structure of the teeth as a result of the low calcium diet.

Teeth of animals fed the deficient diet not only grew more slowly but were also less calcified as shown by X-ray examination, and there was more malposition of teeth among these animals than among the other two groups.

Of animals fed the normal diet 5 per cent., or about one twentieth, had malposition of the teeth, and of those fed the high calcium diet a few more, 6 per cent., had this condition. Among animals fed the low calcium diet the condition occurred in 17 per cent., or nearly one fifth. When the animals were fed for the first year on the deficient diet and for the second year on an adequate diet, the permanent erupted teeth showed a large amount of malocclusion.

Swine were chosen for the investigations because these animals have two sets of teeth, a temporary and a permanent, because they have omnivorous dietary habits, and because they have a comparatively long suckling period for the young. Three types of diet were fed: a normal one, one having a high calcium and low phosphorus content and one having a low calcium, high phosphorus content. The high calcium diet caused a slower growth of teeth and poorer structure than the normal diet, but the growth and structure were better than that of animals fed the low calcium diet.

All the comparisons were made on animals of the same age that had been fed these diets from the very beginning, the mothers having been given the diets while the young were suckling. The experiments were carried out with the cooperation of the U. S. Bureau of Animal Industry and under a grant from the Research Committee of the American Dental Association.

EFFECTS OF LACK OF CALCIUM IN THE BLOOD

CROSSNESS, tiredness, misbehavior and all the other symptoms of problem cases, both child and adult, result when the blood has too little calcium, Dr. Walter Timme, of the Neurological Institute, has concluded. But whether dietary efforts to increase the calcium, by taking lots of milk, fresh fruits, vegetables and cereals would relieve the condition Dr. Timme did not say in his recent address before the New York Academy of Medicine.

Scientists now think that the supply of calcium to the blood is controlled by the tiny parathyroid glands in the neck. When these glands reduce the supply of calcium there is apparently a disturbing effect on the nerves and subsequent conduct of the individual who then misbehaves, showing inordinate fatigability, irritability of temper and at times even incorrigibility, non-amenability to discipline and assaultiveness.

"They were easily aroused to a high pitch of anger at the slightest provocation," Dr. Timme said, "a word, an insinuation or even a glance being sufficient to arouse intense antagonistic reaction. These patients became problem cases at home, at school or in whatever environment they found themselves, because of their non-adaptability and uncompromising attitude. Occasionally their behavior became so exaggerated that apparently hypomanic states developed therefrom and several of these patients had to be confined in institutions until the symptoms were ameliorated. At home, a harsh word from any member of the family, at the table for instance, would result in a plate or knife or some other utensil being thrown at the aggressor. In school, a blow, a shout or a curse would be hurled at a fellow student or even at the teacher."

Upsets in the mutual relationships of the glands and nerves are responsible for many of the drug and alcohol habitues and the easily led characters among the criminal classes.

TEST FOR SCARLET FEVER CARRIERS

A SIMPLE new test for detecting carriers of scarlet fever was described by Dr. Ruth Tunnicliff, of Chicago, before the Laboratory Section of the American Public Health Association at its recent Minneapolis meeting. The test was devised to identify the organism of scarlet fever, and is well adapted for use in detecting carriers. By this test the organism can be identified in from 24 to 48 hours after the culture is made.

Results of a study of Drs. William D. Frost and Myrtle Shaw with R. C. Thomas and Mildred Gumm, from the University of Wisconsin, of the organism that causes septic sore throat were also presented to the laboratory section. Severe epidemics of the disease have been caused by infected milk. The organism may get into milk by outside contamination or it may come directly from infected cows that have a condition known as mastitis. In the latter case, the cows do not always show any symptoms of mastitis. This may be an important factor in the start of the disease even in communities where there is milk inspection. For four years routine examinations

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Applications should record details as to training and experience, accompanied by a recent photograph and not more than four testimonials (in duplicate) **addressed before November 18th, 1929, to the Official Secretary, Office of the Commissioner-General for Australia, 25 Broadway, New York City.**

of milk from all cows and of throats of all employees on farms supplying the Chicago district with certified milk have been made.

Seventeen cows, 8 from the certified herds and 9 from other herds, that were shedding *Streptococcus epidemicus* in their milk have been investigated. About half of them showed no signs of clinical mastitis, and there was such a slight abnormality in the cows and their milk that it was quite evident they would not have been excluded from the herd for a considerable time by a clinical examination.

THE NEW BRITISH AIRSHIP

THE world's largest airship, the *R–101,* built for service on the England-India air route by British governmental engineers, is a novel craft in structure, material, engines and other details. First of Britain's rigid lighter-than-air craft to take the air since the ships planned or started in wartime, the *R–101* in her tests and first long voyages will be watched by aeronautical engineers the world over.

Although some 50 feet shorter than the world-circling German airship, the *Graf Zeppelin,* the *R–101* is 130 feet in diameter, just 30 feet larger than the *Graf.* Its lifting gas displacement is 5,000,000 cubic feet as compared with the 3,710,000 cubic feet of the *Graf Zeppelin.* The *Los Angeles,* the German-built airship of the U. S. Navy, is a million cubic feet capacity smaller than the *Graf Zeppelin.*

The *R–101* is a sister in size to the other British airship, the *R–100* now nearly ready for flight. Whereas the *R–101* is government-built, the *R–100* is the product of the Airship Guarantee Company, a private firm that is building for the government. Slightly fatter and some 55 feet longer than both the *R–101* and the *R–100* are the two U. S. Navy airships that shortly will be laid down at Akron, Ohio, and finished several years hence.

Whereas all other airships built, even the *R–100,* rely on an aluminum alloy, duralumin, as the material for the structural members that form the frame of the airship, the *R–101* principal frames are made of stainless steel tubing, looking much like the frame of an ordinary bicycle. Aluminum alloy is used for minor structural members that support gas bags, walkways and cabins.

The whole of the two-deck passenger cabins, with dining, sleeping and recreational accommodations for one hundred, is contained within the hull in order to reduce the air resistance that would be caused by a car slung below the great cigar-shaped structure. In this construction detail the *R–101* anticipates the new U. S. Navy airship designs.

Hydrogen is the lifting gas used in the *R–101,* since America has a monopoly on the non-inflammable helium gas that holds the *Los Angeles* aloft. Although hydrogen is highly explosive when mixed with air, and voyagers on the *Graf Zeppelin* were rigidly prohibited from smoking, the *R–101* is equipped with a smoking room that would be a credit to an ocean liner. Special ventilating methods prevent any of the dangerous hydrogen gas, millions of feet of which are above the smokers' heads, from entering the smoking compartment. The dining-room on the *R–101* will seat 50 guests. There is a springy floor in the lounge or main cabin that is designed especially for dancing. About the size of a tennis court, the main saloon has a balcony at each end with non-splintering glass observation areas. The sleeping compartments are declared to be more luxurious than those of the ordinary European sleeping car.

For the first time in history a great airship is propelled by heavy oil engines, eliminating the highly inflammable gasoline which is considered as dangerous as hydrogen lifting gas. Five Beardmore engines, each developing 600 horse-power, especially designed for the *R–101,* provide the motive power. These Diesel engines, built for aircraft use, are self-igniting by the heat of fuel compression, and thus spark-plugs and their troubles are eliminated. Since heavy oil is used, carburetors are also lacking. Waste heat from the two engines, which are close to the cabins and saloons, is utilized in heating the quarters of crew and passengers. Fans drive air over a radiator serving both engines and the hot air is circulated in the living quarters.

HIGH-GRADE PAPERS FROM WOOD

HIGH-GRADE bond and permanent record papers, where permanence and durability are essential, have always been made from cotton rag fibers. As a result of an investigation by the U. S. Bureau of Standards, however, it is indicated that certain types of highly purified wood fibers are suitable for conversion into such papers. This will effect considerable saving since the wood fibers are much less expensive than cotton fibers.

Papers carefully prepared from high-grade cotton rags have always been used exclusively where permanence extending over hundreds of years was desired. The cotton fiber is the purest form of cellulose found in nature and cellulose, commonly called alpha cellulose, has a high degree of permanency.

Ordinary wood fibers, on the other hand, have impurities which seriously affect their permanence. By a series of chemical treatments these impurities can be removed, according to the Bureau of Standards, leaving a fiber similar in its chemical composition to the cotton fiber and having the desired paper-making characteristics.

Tests are being made at the Bureau of Standards of the various types of paper-making wood fibers and of several grades of rag fibers. The tests include purity, strength and whiteness.

Complete information can not be obtained by analysis alone. For this reason an accelerated aging test is considered a valuable supplementary test. This is made by heating the paper and finding the degree of deterioration of its physical and chemical properties. This treatment is presumed to simulate the chemical effect of many years of natural aging.

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Kaplan, Leo. *Grundzüge der Psychoanalyse.* Second ed. pp. xi + 397. (Merlin-Verlag) $4.56.

Kirkpatrick, Edwin A. *Fundamentals of child study.* Fourth ed. Revised. 433 pp. (Macmillan) $2.00.

Marcuse, Harry. *Die psychischen Reaktionsformen.* pp. vi + 262. (Abhandlungen 50) (Karger) $5.28.

Moss, Fred August. *Applications of psychology.* 487 pp. Ill. (Houghton) $3.00.

Murchison, Carl. *Social psychology:* the psychology of political dominations. pp. x + 210. (Int. Univ. Series in Psychology) (Clark Univ.) $3.50.

treatment, the fibers are subjected to searching tests to find out how much they have deteriorated both chemically and physically.

A NEW PARIS MUSEUM

A NEW museum has been opened in Paris as the gift of the late Duke of Orleans. In it is a rare collection of mounted specimens of wild life, presented to the public exactly as they appear in real life. There are no glass cases. The animals and birds of each region occupy an enormous room, and are separated from the visitor by a modest railing of which he is almost completely unconscious. Down the middle of the rooms he walks, as it were, on a path through the Arctic and Africa, birds and animals on either side, grouped in life-like positions amid their native vegetation.

Here, in the central African room, stands a giraffe, biting off an interfering branch at the top of a tree, from a lower branch of which a large black snake hangs half-coiled. A monkey is characteristically searching his neighbor for fleas while a group of lions peer threateningly over the tall grass. There are several hundred specimens in this room alone. Every detail in grouping and in reproduction of natural environment has been considered to make the rooms veritable corners of life in the regions represented. Instead of the old method of stuffing with hay or bran, the best animal sculptors were engaged to produce plaster casts over which the skins were pulled. The atmosphere of reality is further enhanced by the paintings on the walls which were done from photographs taken of the regions where the animals and birds were found.

The collection was made, not by a great naturalist, but by a great hunter of royal birth, the late Duke of Orleans, great-grandson of King Louis Philippe of France. Exiled from his native land for fear of a royalist movement, the duke spent forty years of his life in hunting expeditions in the Far North and in Africa. Upon his death he bequeathed his collection to the French Natural History Museum and provided money for a new building in which to house it.

ITEMS

PRESERVATION of the Kaieteur Fall, in British Guiana, is promised in a bill which has recently been drawn up for introduction at the next meeting of the Legislative Council and which will be known as the Kaieteur National Park Ordinance, 1929. The Kaieteur Fall, on the Potaro River, in the County of Essequibo, plunges a sheer descent of 741 feet over a hard ledge of rock 370 feet wide, whose underlying softer layers are worn back into an enormous black cavern, against which the white spray appears with wonderful effect. The escarpment has been worn into a huge amphitheater whose rocky sides surround the whirlpool below, and the surrounding scenery is spectacular and picturesque.

THE Agricultural Experiment Station at Guam has found that sea-water is a cheap and effective means of killing the countless insects that gather in the folds of young, partly opened leaves of trees and shrubs. Certainly there will be no difficulty about a source of supply of the new insecticide. Palm trees, especially, have been benefited by "showers" of several gallons daily. Complete control of the scale insect infesting the coconut palm has been brought about, it is said, by the introduction of predacious lady-bird beetles from the Fiji Islands. Beetles of this family rendered similar service against the citrus scale in California several years ago.

FLOWERS, fruits and vegetables raised by artificial light only in underground hothouses are quite within the realm of possibility, so long as there is a plentiful supply of cheap electricity. So said Samuel G. Hibben, lighting specialist of the Westinghouse Lamp Company, in a report to the Illuminating Engineering Society. Natural sunlight is not necessary for the normal development of plant life, he said. Artificial light has been used with success in the experimental growing of plants in laboratories, and it is being used now as a regular commercial proposition in the speeding up of the maturing of vegetables grown under glass and the blossoming of cut flowers.

BERYLLIUM, a light metal now worth $200 a pound, is likely to find commercial utilization in future aircraft construction, Dr. W. H. Gillett, director of the Battelle Memorial Institute, Columbus, Ohio, has predicted in a report to the American Electrochemical Society. Although now in the rare metal class, beryllium, on account of its light weight, a third that of aluminum, would allow decreases in the weight of aircraft. Designers have estimated that it is worth $40 to reduce the weight of an airplane one pound. Rare as the metal is to-day, Dr. Gillett declared it could be obtained in quantity and at a price of about $25 to $50 a pound if there was demand for it. Geologists estimate that there is as much beryllium by weight in the earth's crust as there is lead or zinc, and much more by volume. Due to its present high cost, little is known about beryllium's ease of fabrication and endurance. It is known to have a higher modulus of elasticity than other light metals and this property, nearly equal that of steel, promises to allow aircraft designers to use methods of construction not now possible.

THE demonstration of the therapeutic effect of desiccated hog's stomach in pernicious anemia, recently reported by Drs. Cyrus C. Sturgis and Raphael Isaacs, of the University of Michigan, and Dr. Elwood A. Sharp, of Parke, Davis and Company, follows by just three years the announcement of the liver treatment for the same disease developed by Drs. G. R. Minot and W. P. Murphy, of Harvard University. Another Harvard scientist, Dr. William B. Castle, has made an epochal contribution to the understanding of the disease by his recent investigations which showed that the required antianemic factor is obtained from beef by the action of the normal gastric juice. Dr. Castle has done his work at the Thorndike Memorial Laboratory of the Boston City Hospital, but because it was reported in *The British Medical Journal*, it was incorrectly stated in *Science News* on September 27 that he was a British scientist.

PSYCHOLOGY—Continued

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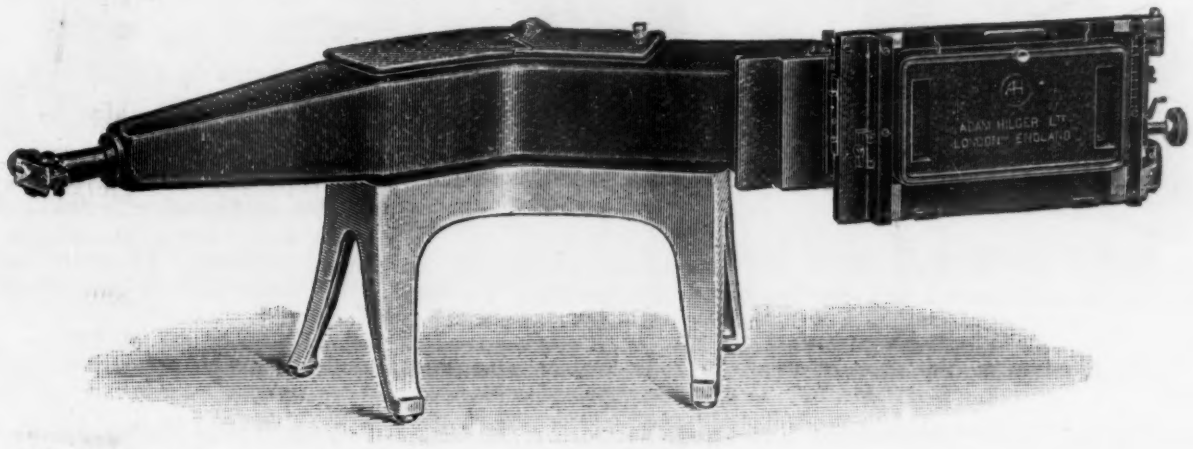

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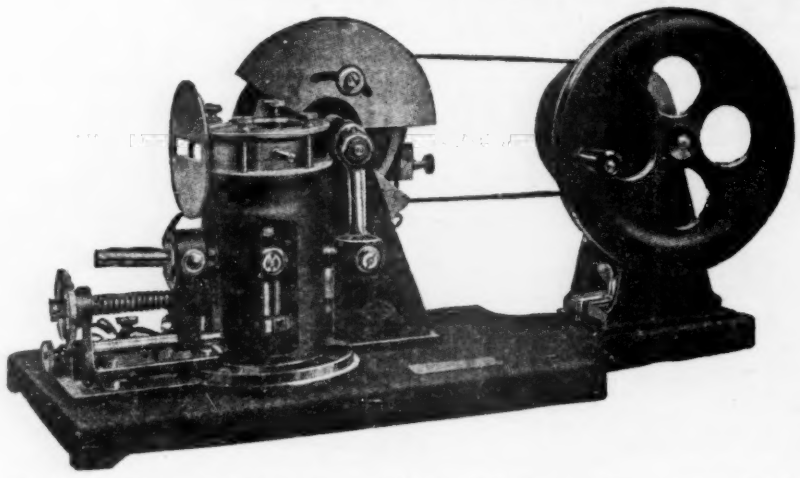

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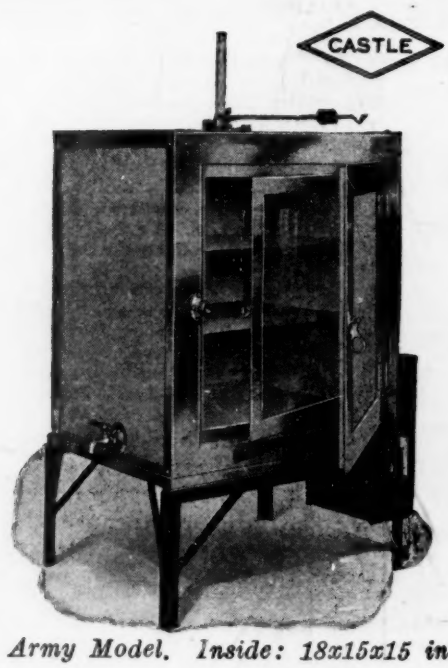

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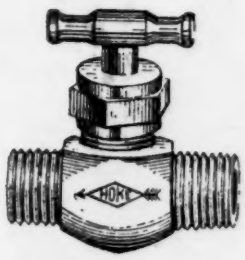

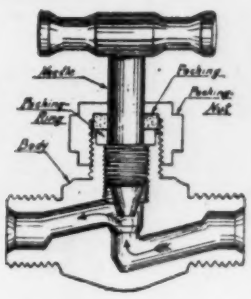

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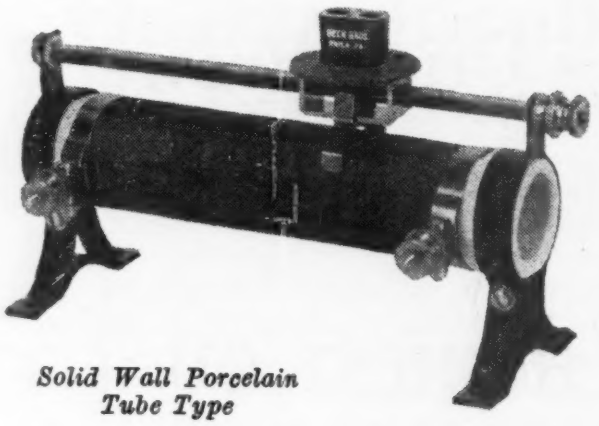

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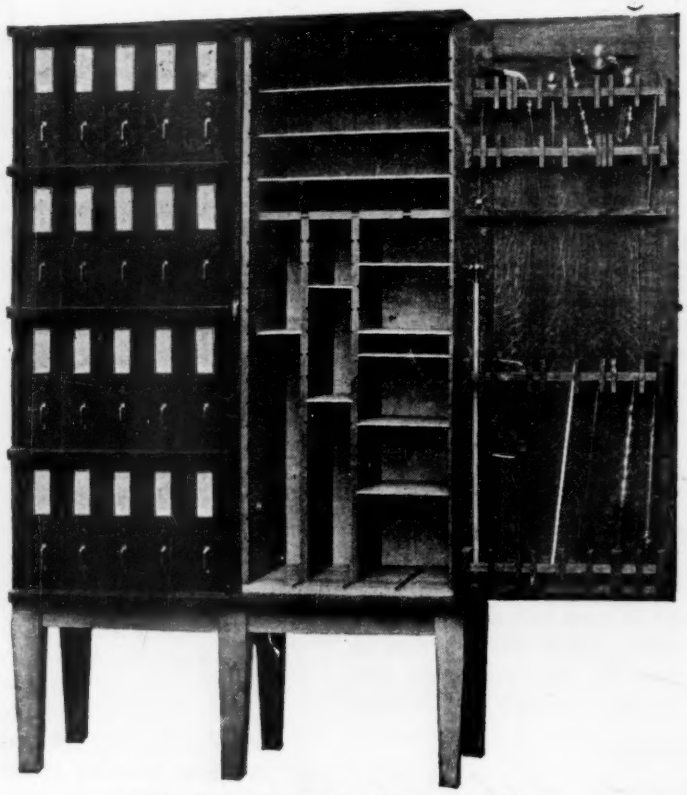

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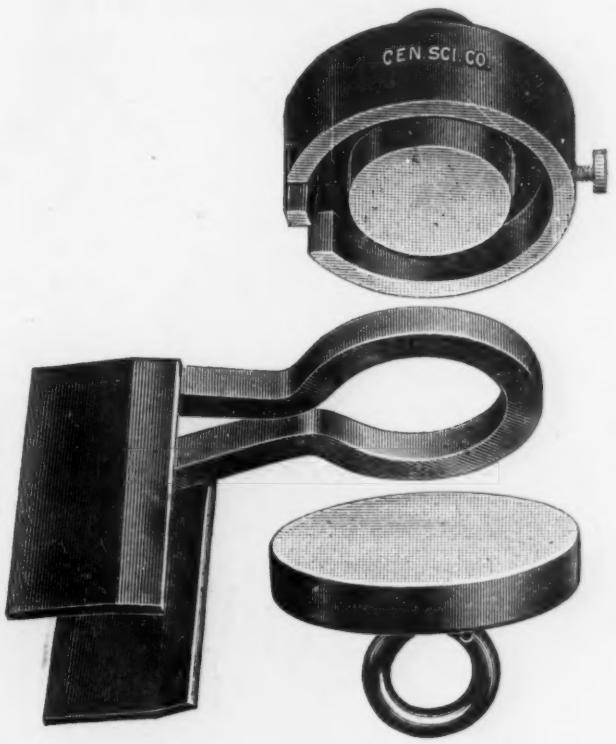

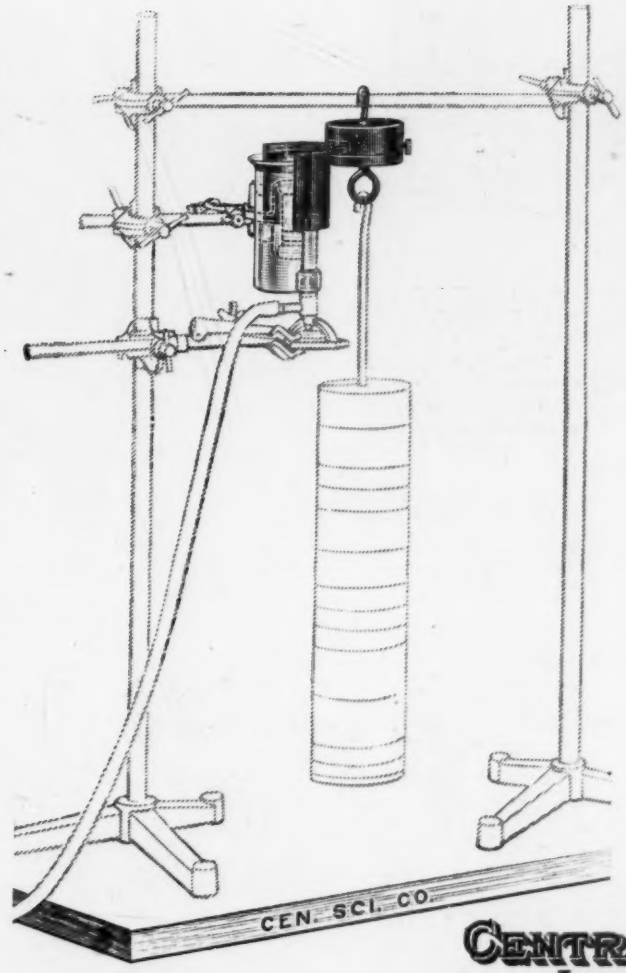

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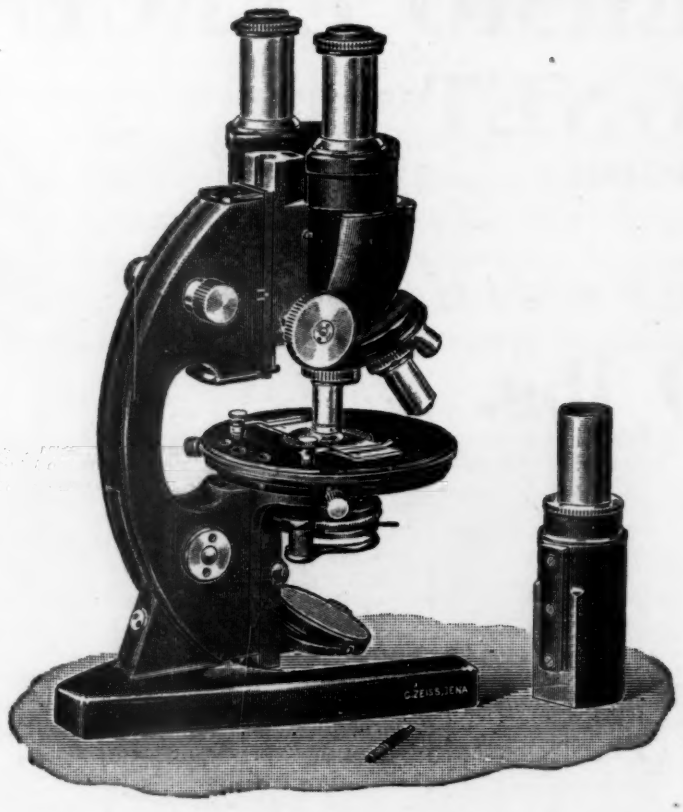

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